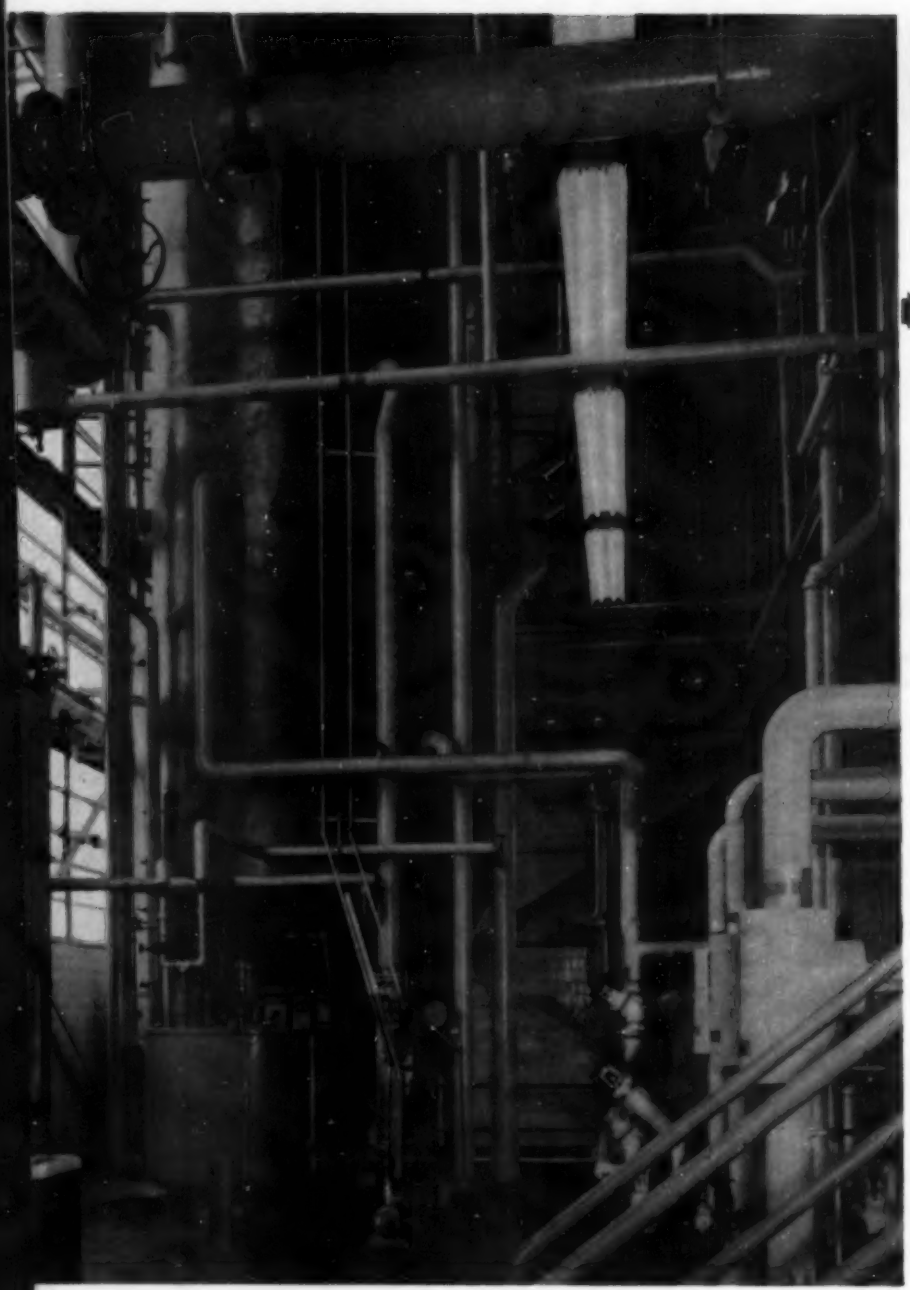
Industry and Power

February 1954



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for engineers and executives responsible for

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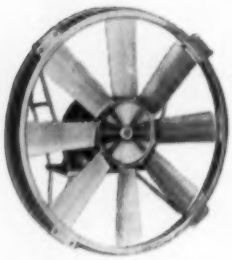
What's New IN INDUSTRIAL AIR—MOVING?

NEW EQUIPMENT

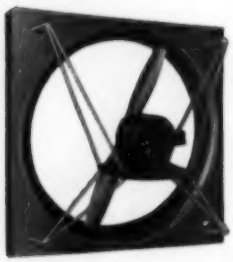


HIGH PRESSURE FAN

All the outstanding features of the standard Hartzell fans, proved in thousands of successful industrial installations, plus a new propeller design which is effective against pressures as high as 4" water gage. 28", 36" and 48".

HIGH TEMPERATURE BLOWER

Now you can move air at temperatures up to 350°, or air containing acids or alkalies, without fear of premature failure of belts and bearings. A powerful blast of air against pressures as high as 7" water gage. 12" to 54".



PANEL FANS

Now you can order the most popular Hartzell fans installed in durable steel panel-type mountings. 24", 28", 32", 36" and 44" fan sizes; single-propeller, two-propeller and multiblade models. Quick and easy to install in any window or wall opening.

HARTZELL

HAS THE ANSWERS

New ideas — new ways to put air to work for industry. In the laboratory and in the field, Hartzell engineers develop a steady stream of them. New equipment to do the job more efficiently. Again it's research plus experience pointing the way to new units which keep the complete Hartzell line ahead of the field, ready with a rugged, reliable fan or blower to meet every industrial air-moving need. And your near-by Hartzell field representative brings the engineering "know-how" of the whole organization right into your plant. Call him the next time you have a tough air-moving problem.

NEW LITERATURE

You'll find a lot of valuable engineering data in these four new bulletins: Bulletin A-108, Fan Engineering Data; Bulletin A-109, Propeller Fans (includes roof ventilators and unit heaters); Bulletin A-110, Vaneaxial Blowers; and Bulletin A-111, Adjustable Pitch Fans. If you don't already have your copies, write for them today.

HARTZELL *propeller fan co.*

Div. of Castle Hills Corp.

Name _____

Company _____

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If student, check here for special information ☐

Dept. B

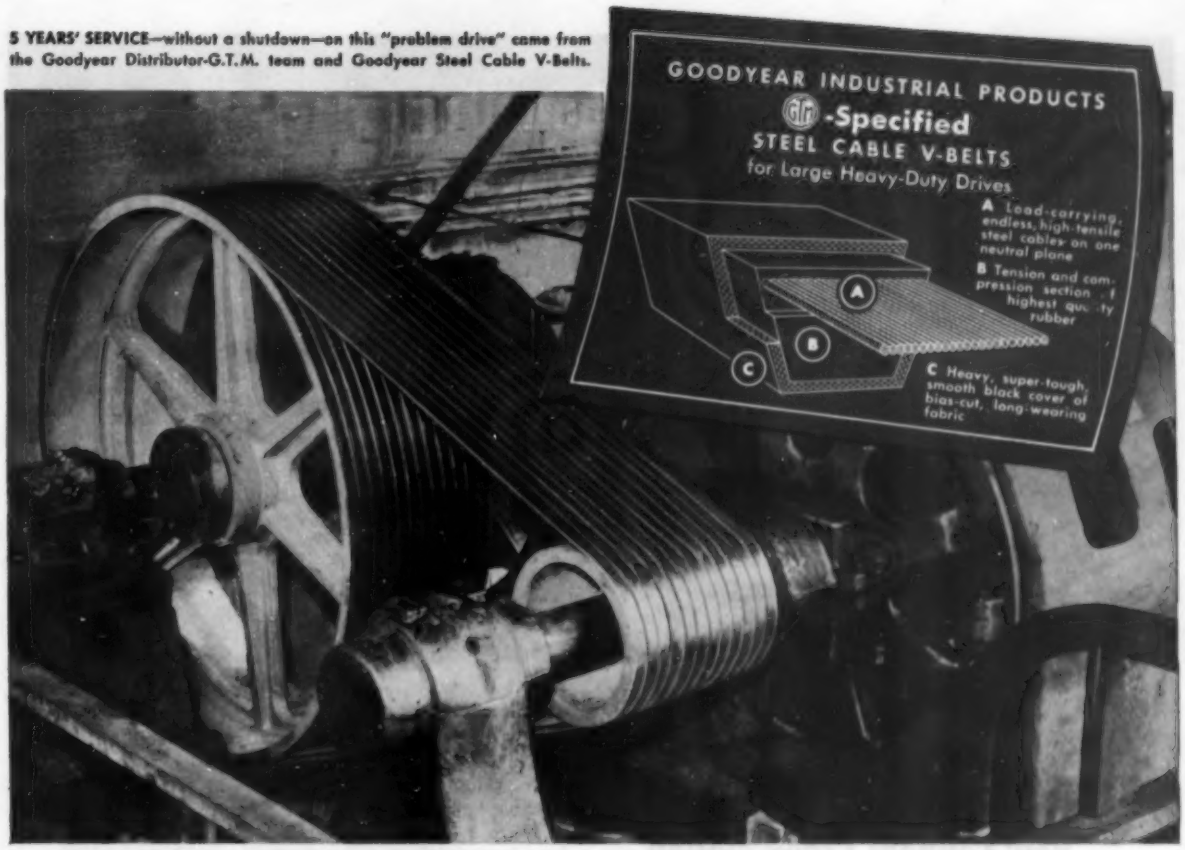
PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

Circle 500 on Reply Card for more data

5 YEARS' SERVICE—without a shutdown—on this "problem drive" came from the Goodyear Distributor-G.T.M. team and Goodyear Steel Cable V-Belts.


GOODYEAR INDUSTRIAL PRODUCTS
GT -Specified
STEEL CABLE V-BELTS
for Large Heavy-Duty Drives
A Load-carrying, endless, high-tensile steel cables on one neutral plane
B Tension and compression section of highest quality rubber
C Heavy, super-tough, smooth black cover of bias-cut, long-wearing fabric
A
B
C

Best V-Belts in the Long Run...

COME FROM YOUR GOODYEAR DISTRIBUTOR

GETTING the maximum service out of V-belts depends on two things: a quality-built product and its proper recommendation. You can get both from your Goodyear Distributor.

The product could be any one of the complete line of V-belts by Goodyear. There are nine basic constructions—all designed to R.M.A. Standard dimensions—all built to the world's highest standards of quality and workmanship. Each of these belts is precision-made to do a specific job best—each is an expert combination of rubber, reinforcement and fabric to give you maximum return for your dollar.

Choosing the right belt for your drive comes natural to your Goodyear Distributor. He is selected because of his experience in the industrial supply field. He is especially trained in drive design and maintenance by Goodyear. He knows belts and how to use them. And should he ever be stopped by a real problem drive, he can always call on the G.T.M.—Goodyear Technical Man—the man who knows V-belts best.

There are many advantages to dealing with your Goodyear Distributor. Tailored service, rapid delivery, simplified billing and reduced inventory are a few. But most important, only he has the right product, the right knowledge and the G.T.M. Look for him in the Yellow Pages of your Telephone Directory or write Goodyear, Industrial Products Division, Akron 16, Ohio.

GOODYEAR

THE GREATEST NAME IN RUBBER

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

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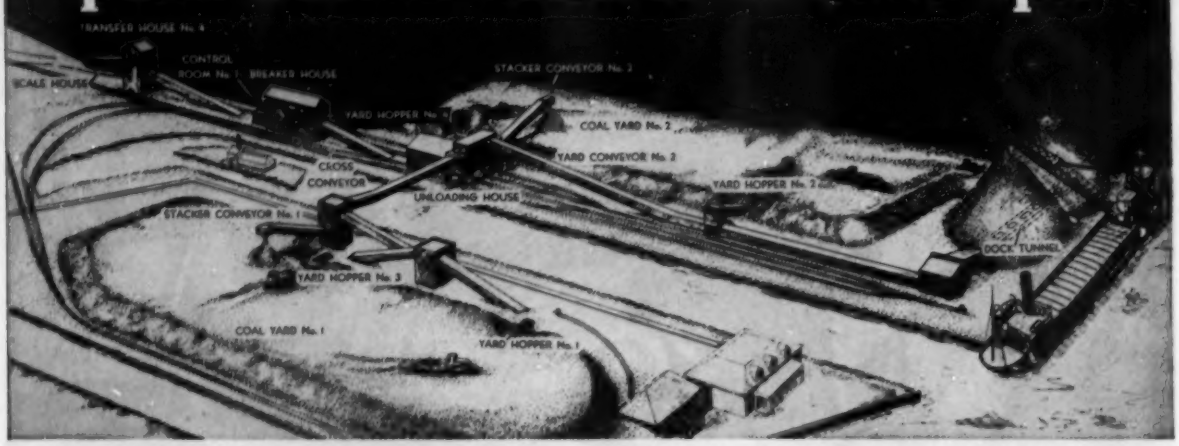
Versatile Link-Belt coal handling system provides push-button control of 2000 tph



Detroit-Edison achieves great flexibility at new Conners Creek station

WHEN the existing low-pressure steam plant at Detroit Edison's Conners Creek station was augmented by a new high-pressure plant, coal handling problems were multiplied. In addition to the extra capacity needed, the two plants use different types of coal.

Here's what the Link-Belt coal handling system had to accomplish:

(1) Receive approximately 1.3 million tons of coal a year by boat and rail.

(2) Handle and keep separate two different kinds of coal.

(3) Store coal in two separate yards or feed directly to power plants.

(4) Maintain centralized control of electrically interlocked system.

(5) Provide continuous, automatic weighing and sampling.

(6) Hold cost per ton handled to the lowest possible figure.

That's a big order. Yet all these requirements have been fulfilled with top efficiency. Two types of coal are unloaded, stored, reclaimed and fed to the plants in any one of eleven sequences the operator selects. Handling costs are among the industry's lowest.

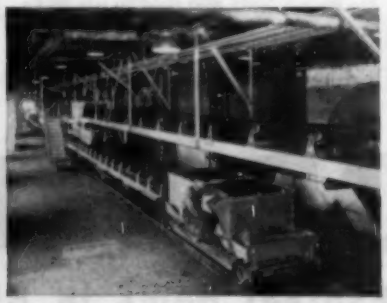
Whether your problem is simple or complex, you, too, will find Link-Belt the best source for your coal handling needs. For all the facts, see your nearby Link-Belt representative or write for Book 2410.

LINK-BELT

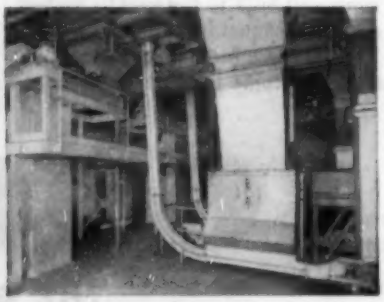
COAL HANDLING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 53.370

Under coal dock, Link-Belt reclaim conveyor is fed by eight belt feeders.



Belt conveyor delivers to reversible shuttle feeder over low-pressure plant bunkers.



Two Bulk-Flo conveyor-elevators deliver coal to crushers for continuous sampling.

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Industry and Power

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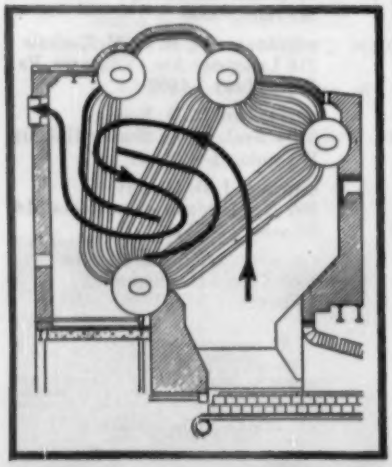
These important fuel-saving, maintenance-reducing features are obtainable with Enco boiler baffles — and only with Enco baffles.

- **Streamlined gas flow**
- **Uniform gas flow**
- **Elimination of bottle necks**
- **Reduced draft losses**
- **Higher heat transfer**
- **Cleaner heating surfaces**
- **Less use of soot blower**
- **Special provision for expansion**
- **Easy tube replacement**
- **Adaptable to any water-tube boiler, fired by any fuel**

Each application is designed on the basis of more than a quarter century of experience in this specialized branch of power engineering. Installations are made by skilled mechanics.



THE ENGINEER CO.
Enco 75 West St. New York 6, N. Y.

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acorns

. . . recently announced . . . worth watching

Tell-Tale Paint

• The extreme heat generated by jet engines and guided missiles calls for a new approach to temperature measurement. A promising thermometer consists of paint which changes color with variations in temperature. Scientists at the Naval Research Laboratory have been able to establish a series of compounds that will record temperatures from 50 C to 278 C. It is expected that future compounds will indicate temperatures in the higher ranges.

Converting Low-Grade Coals

• A process for converting low-grade coals and lignite for use in electrical power generation is described by the U.S. Bureau of Mines.

Lignite is treated in a "fluidized" dryer in which fine particles are suspended in hot gases. The dried lignite is then suitable for fuel in a power plant or it can be further processed into a coke material.

A plant using this technique will soon be in operation at Rockdale, Texas generating 240,000 kw.

New Iron-Base Alloy

• An iron-base alloy, developed as a substitute for stainless steel in the reinforcing braid of Signal Corps lightweight communications cable, has been announced.

The new alloy should be useful in other applications requiring a material that has moderate corrosion resistance, good workability, and that is not easily magnetized.

Insulation Failures

• Failures of buried rubber insulation caused by micro-organisms have been studied and reported on by the Simplex Wire & Cable Co. Experiments show that both natural and synthetic rubber insulation can become electrically leaky when any of several types of fungus send minute filaments through it. Electrical failure can be prevented or greatly delayed by compounding insulations with suitable fungus preventives.

Measuring Air Pollution

• A GE engineer has perfected a new device to measure condensation nuclei—minute air-borne particles on which water will condense.

This device can gauge not only how many nuclei there are per cubic centimeter of air, but also the proportion of those that readily form the tiny water droplets causing fog.

The instrument, not yet generally available, will meet the initial measurement needs in any future scientific studies toward the development of smog-elimination techniques.

Silicone for Tapes

• Known as Dow Corning XC-271, this silicone product has an adhesive strength that compares favorably with that of conventional pressure-sensitive adhesives at room temperature. Furthermore, adhesive strength is retained over a temperature span ranging from -55 F to over 300 F. Highly water repellent and resistant to weathering, oxidation, and a variety of commonly used chemicals, XC-271 also has excellent dielectric properties.

These characteristics suggest the use of XC-271 on glass cloth and tape for high temperature electric and electronic applications, and on low temperature, weather-resistant wrapping and sealing tapes.

Flame-Hardening Equipment

• Flame-hardening of cast iron and steel is being done with specially developed hydraulic equipment adaptable to any size part or tool. The process makes use of a 35 ft lift which permits the handling of shafting or tubing up to 35 ft in length.

Spinning, progressive spinning, or spot hardening of cast iron and steel parts or tools is accomplished automatically, replacing hand methods and other obsolete types of flame-hardening operations.

Nuclear Reactors

• The future may well bring four types of industrial nuclear reactors. They would be reactors used to produce power only, reactors to produce chemicals only, reactors to produce chemicals and power, and reactors used for propulsion purposes such as driving planes and ships.

It is envisioned that an industrial atomic energy program would run hand in hand with the government's program based on a nuclear reactor that would produce plutonium for government stockpiles and utilize by-product heat to make power.

The Small Valve
THAT DOES THE
BIG JOB

Here's what you get: Extra protection against excessive stress with new extra-strong stem and wedge-gate connection . . . super-hardened seat rings of stainless steel . . . forged body and yoke (and bolted follower that has no threads to corrode) . . . plus Malcomized gate faces that won't seize or gall. Made in sizes from ½" to 2" inclusive, with choice of rising stem with yoke, or with inside screw. Bonnet joints either gasketed or metal-to-metal. Pressure range: 2,000 lb. at 100°F. — 380 lb. at 1,000°F. For higher pressures, specify List 990. Write for Catalog 10.

The CHAPMAN VALVE MFG. COMPANY
INDIAN ORCHARD, MASS.

LIST 960
CHAPMAN

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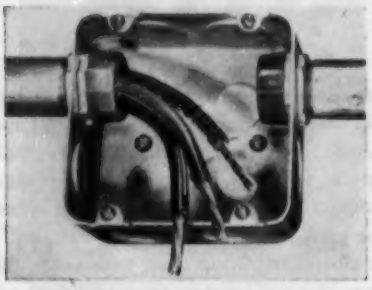
new equipment

. . . new developments



Insulating bushing is shatter-proof

B10 Shatter-proof insulating bushing for ½ to six inch standard rigid electrical conduit is announced by The Thomas & Betts Company. Made from a special cellulose acetate butyrate formula, the new bushing is said to be tough and resilient, and will not shatter if accidentally struck by tools or if dropped on a concrete floor during installation. Additional features of the new bushing include a fold-back throat, dual-purpose threads, ease of handling and bright blue coloring.

Moisture separator is for use in horizontal lines

B11 Separators for use in horizontal steam, air, and gas lines are announced by Wright-Austin Co. Known as the 31-N separator, it is a refinement of the 30-N type separator. It installs in minimum space, occupying little more space than the section of pipe it replaces, is self cleaning, and may be used with a wide range of pressures. Construction is of fabricated steel.

Adjustments possible while burner is in operation

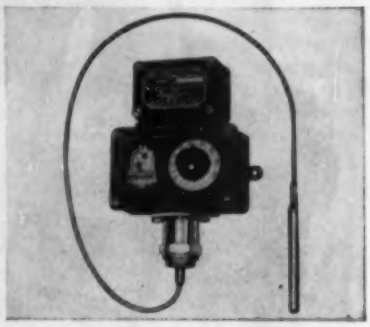
B12 Model C-1-A, heavy-duty pressure atomizing commercial oil burner designed by the Iron Fireman Manufacturing Co. for firing CS No. 2 or lighter fuel, is available in capacities ranging from four to eight gallons per hour. Adjustments can be made while the burner is in actual operation, facilitating setting of the burner for maximum combustion efficiency and allowing the most suitable flame shape for the combustion chamber. It is equipped with a totally enclosed, permanently lubricated, ball bearing motor produced by the Electronics Div. of this company. Burners are available for use either with stack switch or electronic controls in draft tube lengths of 9, 16, or 22 in., and feature twin nozzles for improved atomization.

Tool has pulling power of eight men

B13 The Powered Cable Puller, manufactured by the Barth Corp., is portable and can be operated in any position for either pushing or pulling purposes. It pushes 25 ft of fish tape per min around five 90 deg bends, stopping automatically if conduit is obstructed, or it pulls 15 ft of wire per min into ¾ to 2 in. conduit. The machine provides 175 ft of .060 x ¼ in. usable tape, operates on 115-v ac or dc and pulls 1200 lb dead weight, equivalent to the pulling power of eight men.

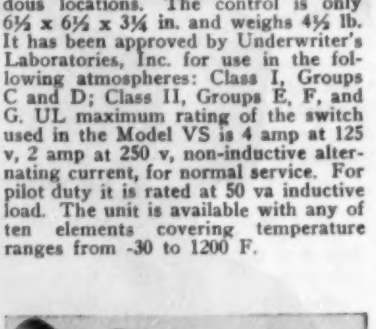
High-heat aluminum paint fuses to the surface

B14 Thermalite, a high-heat aluminum paint made by Tropical Paint & Oil Co., was developed for use on metal surfaces with temperatures ranging from 400 to 1000 F. Formulated with a special heavy silicone content, Thermalite is said to fuse to the surface, will not discolor, blister, flake, or burn off, and gives exceptional protection against severe weather. It is available for both interior and exterior use.



Temperature control is explosion proof

B15 Partlow Corporation has developed a compact, non-indicating explosion-proof temperature control for application in many hazardous locations. The control is only 6½ x 6½ x 3¼ in. and weighs 4½ lb. It has been approved by Underwriter's Laboratories, Inc. for use in the following atmospheres: Class I, Groups C and D; Class II, Groups E, F, and G. UL maximum rating of the switch used in the Model VS is 4 amp at 125 v, 2 amp at 250 v, non-inductive alternating current, for normal service. For pilot duty it is rated at 50 va inductive load. The unit is available with any of ten elements covering temperature ranges from -30 to 1200 F.



Rotary joints are for high or low-pressure systems

B16 Phillips Rotary Joints, packless and leakproof, operate on the ball-and-socket principle, and are manufactured in two types: the Thru-Flo type, a single inlet unit designed to

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card, pages 34/35 & 98/99.

This building was "protected" too.

Explosion Collapses Stack Wrecks Plant

A violent Flame-Failure explosion at the [redacted] Dairy completely wrecked the boiler room, and collapsed the brickstack. The stack, raised in the air by the explosion, fell through the roof, severely injuring many.

The cause of the explosion was fuel pouring in unchecked after burner Flame-Failure, and igniting on hot fire brick.

but— like 4 out of 5 burner installations, the Flame-Failure Protection was too slow to prevent explosion!

Most plants and buildings have flame-failure protection of some kind — and *think* they are safe. The fact is, however, that 4 out of 5 plants burning oil, gas or coal simply do not have Flame-Failure protection that meets insurance company standards. Your burners should have safeguards that shut off fuel in 2 to 4 seconds after a burner flame-failure. Explosive gases collect fast — faster, actually, than any human or mechanical "safeguard" can act.

Today, it is unnecessary to depend on slow, half-safe controls. It costs so little to replace them with the modern FIREYE System — the only fully approved, complete and instantaneous safeguard for all types of fuels. With FIREYE, an electronic eye "sees" the burner flame . . . and if the flame fails, it works with the speed of light to cut off fuel and warn operating personnel. FIREYE Systems are quickly and easily installed, and the cost is low.

BE SAFE! SEND TODAY! Send now for this authoritative guide, compiled by the pioneers of *instant* electronic Flame-Failure protection. Long experience in the research and manufacturing of FIREYE Flame-Failure safeguards makes Combustion Control Corporation the one company best qualified to write on this subject — the one company offering you Firetron, the Flame-Failure sensitive cell that sets the standard of dependability.

COMBUSTION CONTROL CORPORATION

Dept. WB-2 • • 718 Beacon Street, Boston, Mass.

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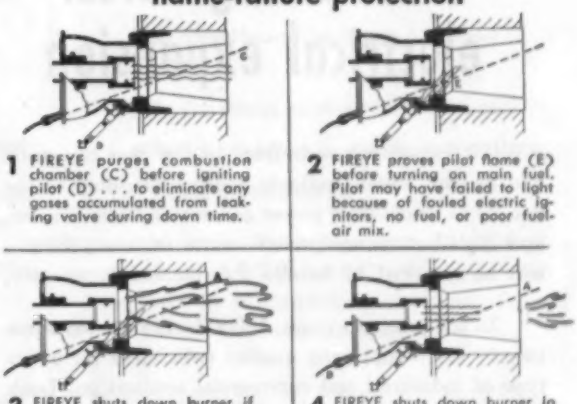
How fireye gives you complete flame-failure protection



1 FIREYE purges combustion chamber (C) before igniting pilot (D) . . . to eliminate any gases accumulated from leaking valve during down time.

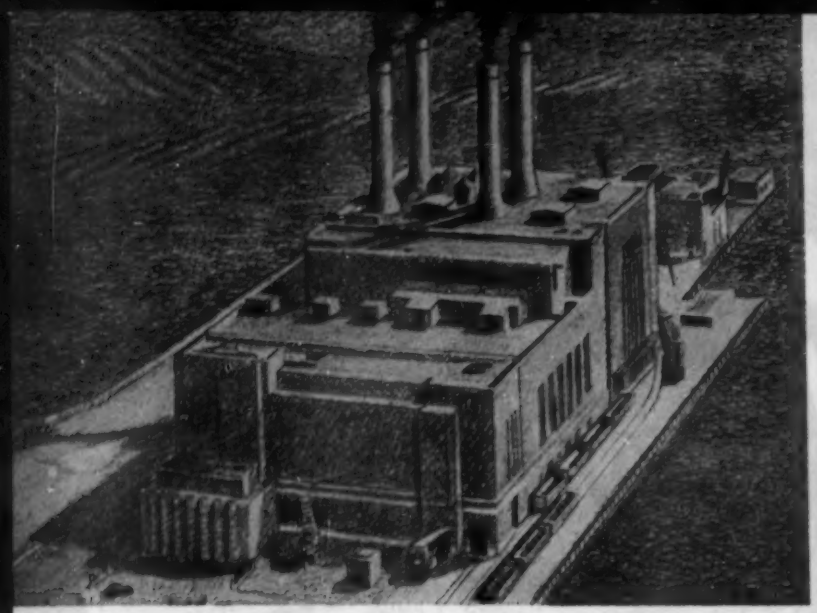
2 FIREYE proves pilot flame (E) before turning on main fuel. Pilot may have failed to light because of fouled electric ignitors, no fuel, or poor fuel-air mix.

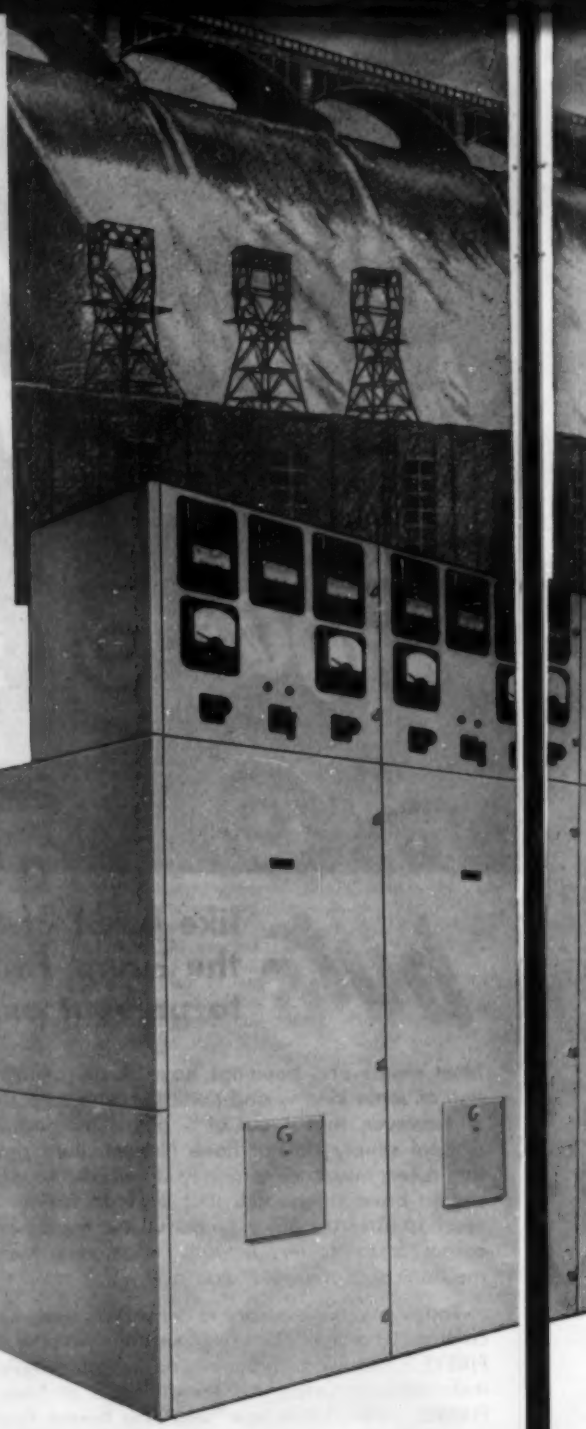
3 FIREYE shuts down burner if main flame (A) is not ignited at end of safe trial period (due to no fuel, poor fuel-air ratio, or incorrect draft.)

4 FIREYE shuts down burner in 2 to 4 seconds if main flame fails due to poor fuel-air ratio or draft, or fuel interruption. POSITIVELY PREVENTS EXPLOSION.

fireye

FIRST and FOREMOST IN INSTANT FLAME-FAILURE PROTECTION





A TRILLION KWHR by 1965*

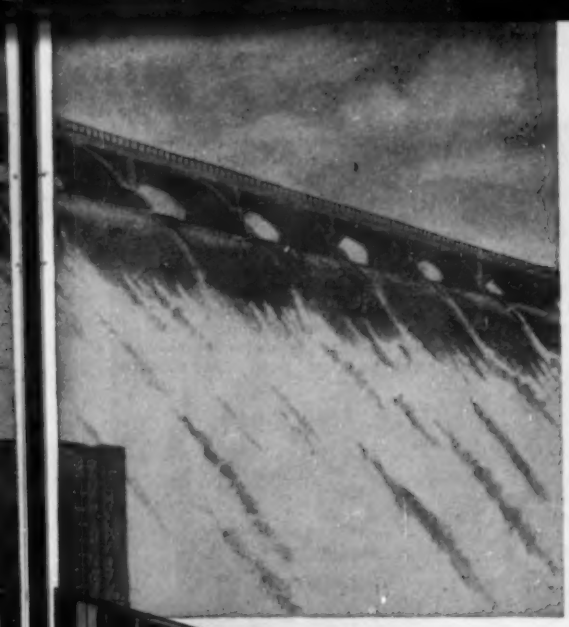
I-T-E is pacing America's greatest electrical expansion

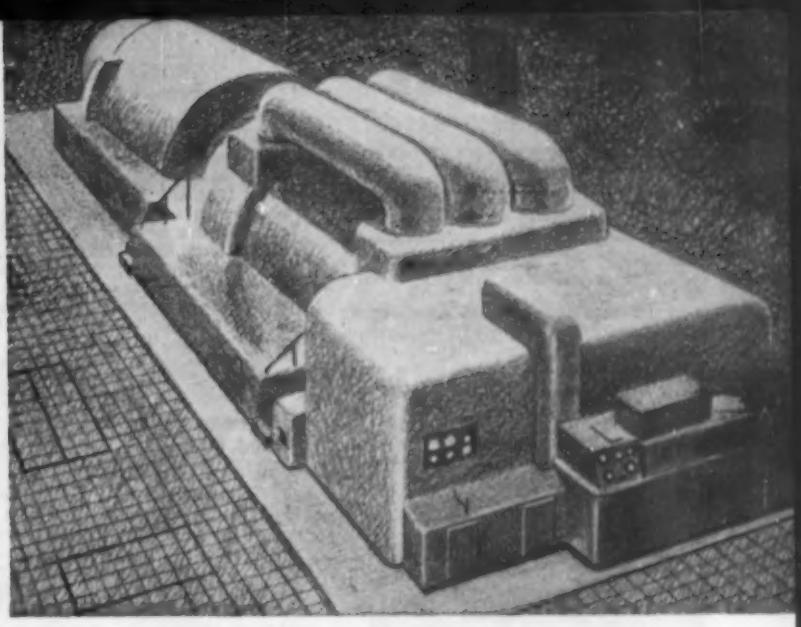
KWHR capacity has doubled in the past ten years and present trends indicate another doubling in the decade to come. New power generation, transmission, and distribution equipment—more of everything—will be required to handle this increased capacity.

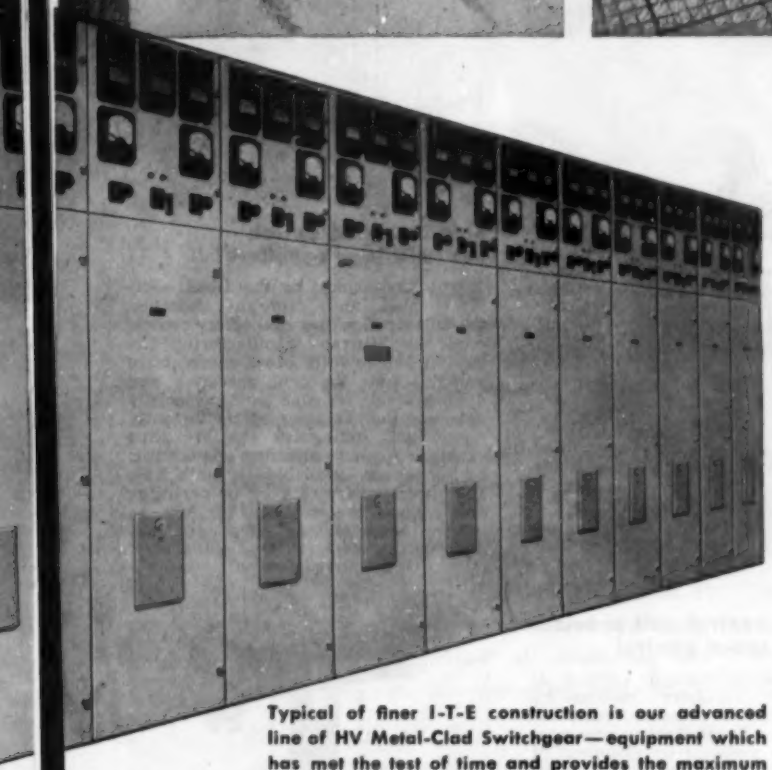
In the past ten years, I-T-E has expanded some twenty fold—supplying quality switchgear for every type of industrial and commercial application. Look for even bigger strides forward—broader lines, more products, finer designs, and increased production—as I-T-E continues to pace America's greatest electrical expansion.

**Edison Electric Institute*

THE SYMBOL OF QUALITY SWITCHGEAR







Typical of finer I-T-E construction is our advanced line of HV Metal-Clad Switchgear—equipment which has met the test of time and provides the maximum in protection and efficiency at a minimum over-all cost.

For details, call the I-T-E field office nearest you. Look in your classified telephone directory under "Electrical Equipment."

Or—write for **Bulletin No. 7004B.**

I-T-E Switchgear embodies...

- **advanced engineering**
- **refined design**
- **quality construction**

Through 65 years, the I-T-E Circuit Breaker Company has achieved outstanding recognition in the industry by persistent effort to advance the switchgear art.

Many switchgear "firsts" are attributed to I-T-E, among them:

- the original Inverse Time-Element (I-T-E) circuit breaker
- the first enclosed circuit breakers and switchboards
- the first high-voltage air magnetic circuit breaker
- the first isolated-phase bus

In addition to the introduction of new ideas and thinking, I-T-E has devoted its engineering skill to accomplishing the ultimate in design and production refinement.

I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.

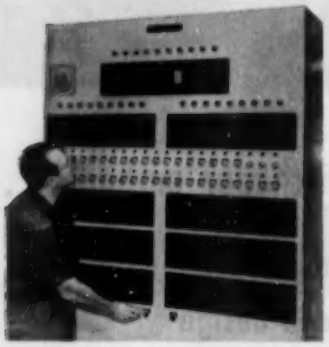
I-T-E Metal-Clad Switchgear

Circle 506 on Reply Card for more data

new equipment

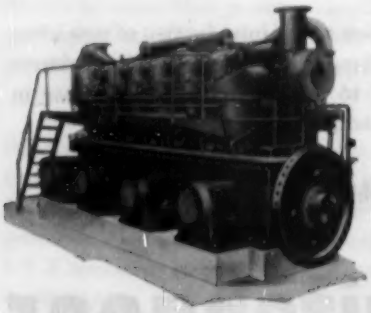
—Starts on page 8

transfer liquids or steam into or out of any revolving drum; and the Syphon Type, designed for installations where inlet and outlet are desired in the same unit, or for syphon drainage of condensate from the steam chambers of a roll or drum. They can be used in both high and low pressure installations. The Key Co. is the distributor.



Visual sequence annunciator analyzes cause of shut-down

B17 Panalarm Products, Inc. has developed an annunciator system which automatically indicates the sequence of "off-normal" alarms. These visual sequence annunciators are desirable where alarms are applied to closely inter-related variables. They pinpoint the cause of troube by indicating the first variable to go "off-normal". Alarm signals are grouped for sequential lock-out by simple jumper connections on the rear terminal block, and any number of inter-related groups may be formed or interchanged as desired. The entire system is suitable for Class 1, Division 2 locations, and is available in standard Panalarm backlighted nameplate cabinets providing from 3 to 48 signals.

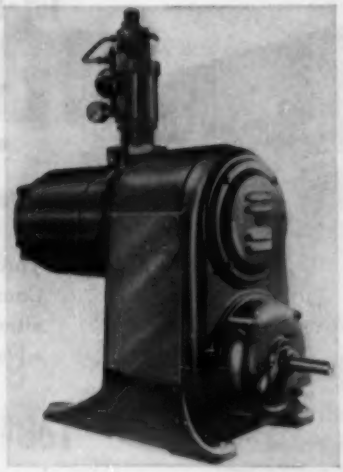


Gas-engine-driven compressor is turbocharged

B18 By applying turbocharging, a 2000-hp four-cycle unit has been designed by Ingersoll-Rand Co. The crankshaft, designed with compound crankpins, contributes to the reduction in size and weight. Compression ratio of this type 412 KVS engine is only 6.1, resulting in a compression pressure of 225 psi and a firing pressure of 600 psi at 2000 bhp. Rated bmep is 121.6, giving the turbocharged engine a very conservative rating with ample capacity for normal overloads. The fuel rate of 7600 btu per bhp-hr at full load is also exceptionally low.

Kilogram scales are added to line

B19 Kilogram scales for the export trade are now available from Hydroway Scales, Inc. at the same cost as the company's standard tonnage scales of equivalent size and capacity. Combination reading pound-kilogram scales remain available in a more limited size range at slight additional cost.



Pneumatic control unit provides automatic speed control

B20 Automatic speed control of U. S. Varidrive motors by such variables as pressure, temperature, speed, or liquid level is now possible through a recent development of U. S. Electrical Motors Inc. An improved pneumatic control called Varitrol, which may be operated either manually or automatically, has been designed into the U. S. variable speed motor—Varidrive. Designed to operate on a supply air pressure of 60 to 100 psi, the Varitrol is presently available on Varidrives from 1 to 30 hp and can be supplied up to 50 hp. Literature is available.

Controls signal when regeneration is needed

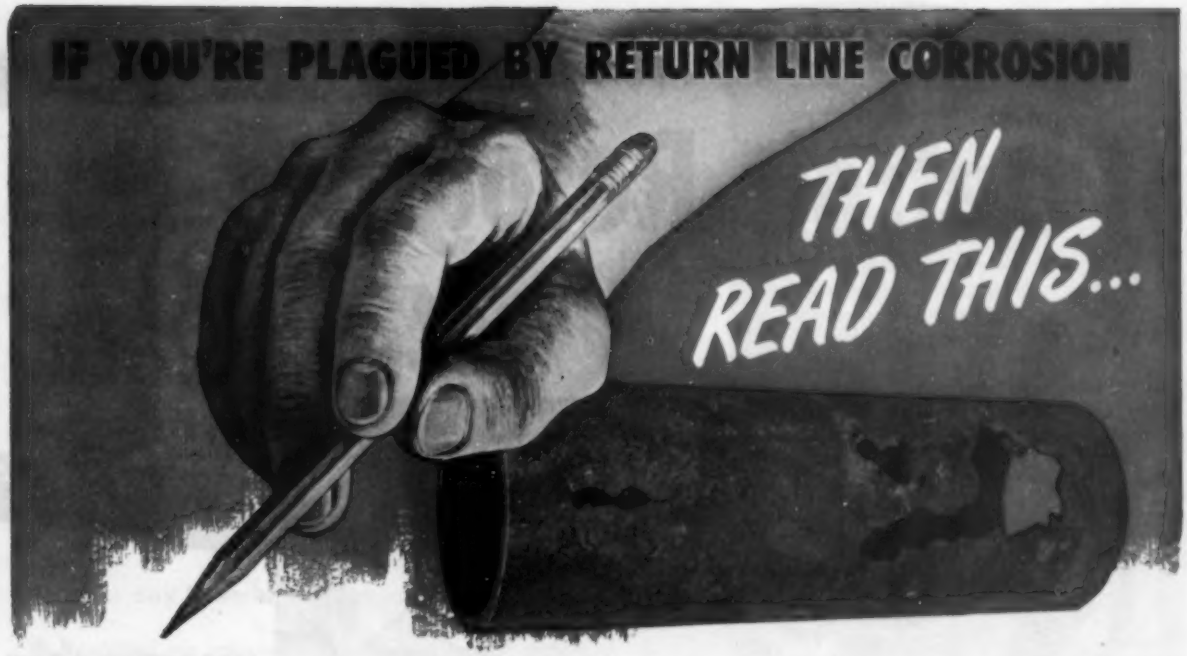
B21 The Penfield Manufacturing Company's demineralizer is now equipped with special controls which enable the automatic maintenance of storage tank water supplies at a definite known purity standard. After the regeneration cycle has been completed and is in its final rinse stage, the operator switches on the unit's automatic controls which then perform all required functions completely automatically, including signaling when another regeneration cycle is needed. Once these automatic controls take over, the effluent continues to run to drain until a desired preset conductivity (purity) has been reached. At this time, the high purity water being produced starts to flow to the storage tank and continues to flow until the storage tank is filled.

Side operated switch has built-in arc-snuffers

B22 Companion to the front operated and raintight switches, the 30 amp side operated safety switch, made by Murray Manufacturing Co. has the strong rotor blade construction which allows for cool operation and double break on each pole. Specially designed built-in arc-snuffers instantly divide and extinguish the arc thus saving wear and extending contact life. Switches are available in both two and three wire with plug or cartridge fuse. They are suitable for use as service entrance equipment and are designed to protect light machinery.

Refractory gun is lightweight

B23 To reduce the cost of many time-consuming hand-applied refractory jobs in small ladles and other confined places, VIBRON Division of the Burgess-Sterbentz Corp., has developed a compact pneumatic refractory gun. This VIBRON Bantam makes it possible to apply refractories with 40 to 50 percent less moisture and thus produce longer-lasting refractory linings or patches. The unit,



As an engineer responsible for efficient, economical plant operation, you know only too well that corrosion of steam and condensate lines can send costs skyrocketing through pipe replacement, interrupted production, and increased labor and maintenance. Perhaps you, like many other engineers, have tried stop-gap methods to check the problem only to find them partially effective or far too costly.

Realizing the importance of this major industrial problem, Betz Laboratories has developed its patented filming amine treatment. Here, at last, is a simple, inexpensive, and practically 100% effective method of eliminating this costly and production-disrupting headache.

For example, a linoleum company, operating at 150 psi and producing 300,000 pounds of steam per day, employed sodium zeolite softening for a high bicarbonate raw water. The carbon dioxide content of the steam averaged 40 ppm. Continued maintenance was required due to failure of condensate lines from the steam kettles and unit heaters. After the filming amine treatment was applied, maintenance records showed an annual saving of approximately $8,000.00! And, a large part of this saving was obtained by eliminating weekend over-time work on pipe replacements.

Why not take the first step toward ridding your plant of corrosion *now*? Call in a Betz Engineer. Ask him to show you how Betz *Specialized* Water Conditioning Service can help you . . . quickly . . . economically . . . effectively. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

See for yourself how Betz filming amine treatment eliminates return line corrosion and reduces operating costs. Send for Technical Bulletin No. 124.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

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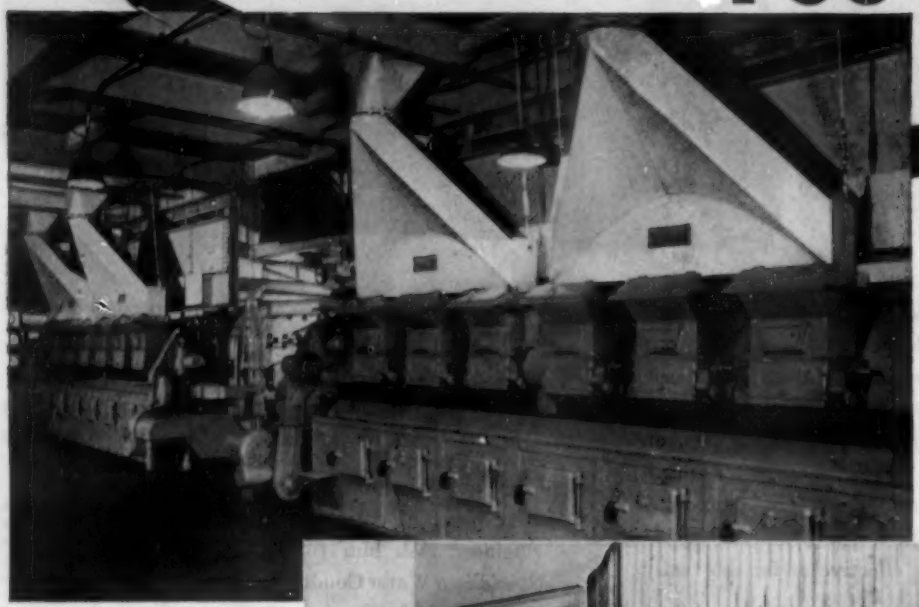
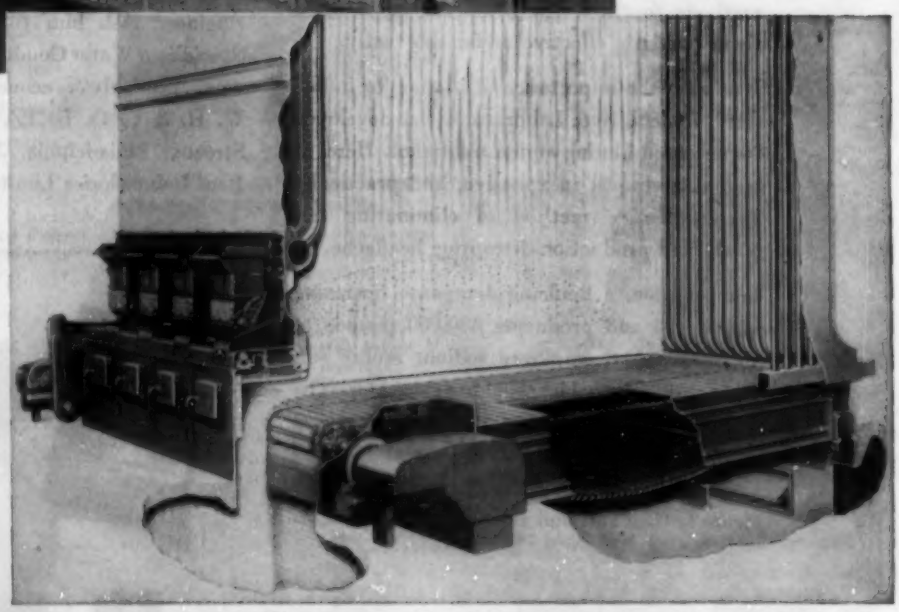
Detroit Rotograte Has You Need



Typical installation of Detroit RotoGrate Stokers in prominent Midwestern Plant. Units designed for capacities of 150,000 pounds of steam per hour each.



Cut-away view of a typical water cooled furnace of a steam generator. Two feeders are removed to show the specially designed overlapping grate that moves slowly forward to continuously discharge the ash at the front. A scientifically designed reinjection system provides effective furnace turbulence.

Detroit RotoGrate Stokers may be applied to all types and makes of boilers or steam generators, and are available for capacities up to 400,000 pounds of steam per hour per unit.

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN

Works at Monroe, Michigan • District Offices in Principal Cities

The Features in a Stoker:

- **Burns any Bituminous coal or Lignite.**
- **Requires no special fuel preparation.**
- **Exceptional fuel economy.**
- **Low auxiliary power.**
- **Increased capacities due to higher burning rates.**
- **Responsive to fluctuating loads.**
- **Continuous ash discharge eliminates intermittent cleaning.**
- **Coal feed, air supply and ash discharge are automatically controlled.**
- **Air for combustion may be preheated.**
- **Availability high—Maintenance low.**

Hundreds of such RotoGrate installations have been made since first introduced by us in 1938. Repeat order customers are best evidence of satisfactory performance.

Do you need more steam? If so, investigate and order your Detroit Stokers now. Whether you are an old or new customer, we are at your service. Write for catalog.

There is a type and size of Detroit Stoker for every Industrial or Commercial need.

DETROIT ROTOGRATE STOKER

REPRESENTATIVE INDUSTRIAL ROTOGRATE USERS

- *Abitibi Power & Paper Co., Ltd.
- *Allied Chemical & Dye Corp.
- *Amalgamated Sugar Co.
- *American Crystal Sugar Co.
- American Cyanamid Co.
- American Distilling Co.
- American Steel Foundries
- Campbell Soup Co.
- Capitol City Products Co.
- Carborundum Co.
- *J. I. Case Co.
- Certain-teed Products Corp.
- Chesapeake & Ohio Railway Co.
- Chicago & Northwestern Railway Co.
- *Chrysler Corp.
- Clinton Industries, Inc.
- *Consolidated Paper Co.
- *Peter Cooper Corps.
- Crane Co.
- Crucible Steel Co. of America
- Cudahy Bros. Co.
- E. I. DuPont de Nemours & Co.
- Elliott Co., Inc.
- Falk Corp.
- *General Electric Co.
- *General Motors Corp.
- Goodyear Tire & Rubber Co., Inc.
- *Great Western Sugar Co.
- Hoberg Paper Mills, Inc.
- Illinois Central System
- Interlake Iron Corp.
- Jeffrey Mfg. Co.
- Jones & Laughlin Steel Corp.
- Kimberly-Clark Corp.
- *Libby-Owens Ford Glass Co.
- *Eli Lilly & Co.
- *Minnesota Mining & Mfg. Co.
- *Monsanto Chemical Co.
- *Nash-Kelvinator Corp.
- *New York Central System
- *Northwest Paper Co.
- Pabst Brewing Co.
- Pacific Mills
- *Pullman Standard Car Mfg. Co.
- Quaker Oats Co.
- Rochester & Pittsburgh Coal Co.
- *Rohm & Haas Co.
- Schmidt & Ault Paper Co.
- *Studebaker Corp.
- *Sutherland Paper Co.
- Tennessee Coal, Iron & Railroad Co
- *Tennessee Eastman Corp.
- United States Gypsum Co.
- United States Rubber Co.
- *Walworth Co., Inc.
- Western Electric Co., Inc.
- Wilson & Co., Inc.
- *Wyman-Gordon Co.

*Repeat Order Plants

Circle 508 on Reply Card for more data

new equipment

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which weighs only five pounds, operates at greatest efficiency between 85 to 130 psi. The gun comes equipped with a 10-foot flexible air hose and quick connect swivel coupling.

Offset scale is for low overhead installations

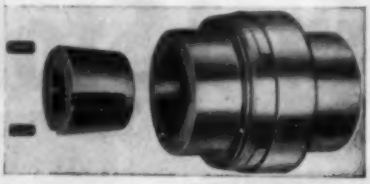
B24 Sintering Machinery Corp., Transportometer Div., has designed an offset weighing scale for use on new or existing belt conveyor installations where overhead clearance is limited. All Transportometers, including the unit illustrated, employ a standard, completely mechanical, gear differential integrator which automatically and continuously records the product of the belt speed and the momentary weight passing over the scale suspension. Weighing accuracy over its entire range is said to be 99½ percent or better, regardless of belt speed or tonnage variations. Capacities to be handled are governed only by the capacity of the conveyor belt.

Cover extends conveyor belt life

B26 A conveyor belt cover which is said to promise high resistance to abrasion and tearing, meaning longer conveyor belt life, especially under heavily abrasive conditions, has been developed by Manhattan Rubber Div. of Raybestos-Manhattan, Inc. Known as the XDC conveyor belt cover, it is being applied to a wide range of this company's belts. It is also said to provide the truest balance-of-wear between strength members and cover yet devised, besides giving superior flex life and added resiliency.

Centrifugal force utilized in dust collector

B27 The mechanical dust collector, Dustmaster, announced by A. W. Banister Co., Inc., separates dust from air by means of centrifugal force. It has application in industrial plants for removing dust, for collecting valuable materials from dust, or as a precleaner for filters and electric precipitators. Built in standard sizes from 18 to 84 in. dia, they are available in single, duplex, quadruplicate, and two-stage arrangements. They can be operated either under suction or pressure and are for applications in which the gas temperature is less than 800 F. Literature is available.



Couplings adapted for use with taper-lock bushings

B28 Three sizes of Type C Couplings adapted for use with Dodge Taper-Lock Bushings are announced by Lovejoy Flexible Coupling Co. Sizes are: C-191 (Dodge Bushing No. 2012) for bores ⅛ to 2 in.; C-226 and C-276 (Dodge Bushing No. 2517) for ⅛ to 2½ in. bores.

V-belt has 40 percent more horsepower capacity

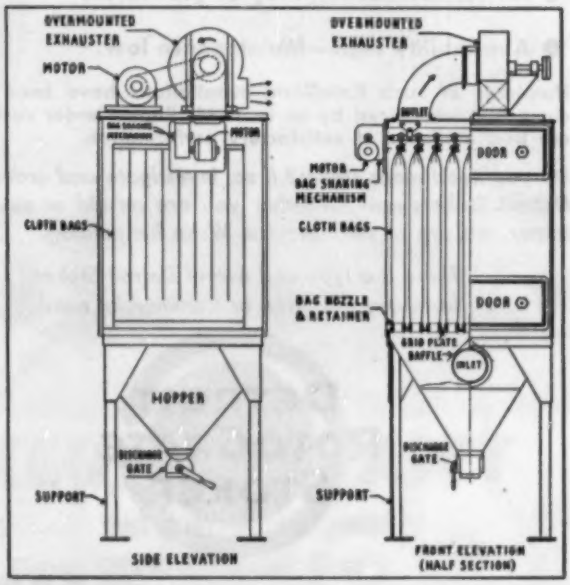
B29 An improved V-belt developed by Raybestos-Manhattan, Inc., the Manhattan Rubber Division is said to provide 40 percent greater horsepower capacity and to last relatively longer than standard V-belts. On new drives, narrower sheaves may be used, saving space, because fewer belts are required for the same power demands. This Super-Power V-belt has practi-

Unit type dust collector is for smaller air volume

B25 Unit-Type CN cloth bag collector, designed for economical and efficient dust collection for smaller volume applications, is announced by Pangborn Corp. Each unit is self contained and shipped assembled ready for installation. This collector is designed for indoor use and cleaned air can frequently be discharged inside the plant — a distinct saving where air is heated or cooled. Finely divided dusts such as carbon black, cork, and metal oxides, are collected through cloth filter bags similar to this company's Type CM dust collector.

Dust laden air enters the collector where it is expanded in a settling chamber. Here, the reduction in velocity drops coarser dust particles directly into the hopper. A baffle plate prevents the air from rising immediately to the cloth bags, and therefore the only escape for air is through the open bottom of the bags. This air then flows into the bags where the fine dust particles are filtered on the bags' inner surfaces. Cleaned air passes through the bags and is discharged from the collector. Air flow through the collector can be shut off whenever necessary and the bags mechanically shaken to remove dust from their inner surfaces. This dust falls directly into the hopper for removal and disposal.

Seven sizes are available, ranging from 200 to 1000 sq ft of cloth area. Sizes 200 to 500, inclusive, have one hopper and nine bags. Sizes 600, 800, and 1000 are double sections of the 300, 400, and 500 sizes, featuring two hoppers and 18 bags, but only one air inlet and one settling chamber.

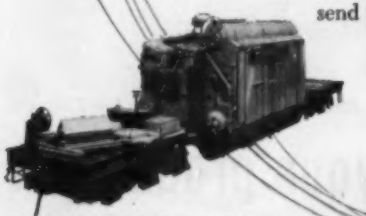


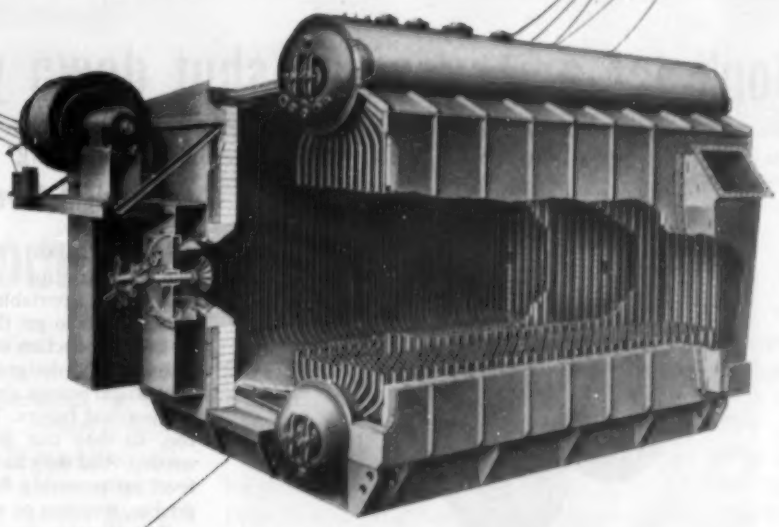
Who's buying VP boilers?

A quick perusal of the list below indicates that, varietywise, almost everyone is. Big companies and small companies representing many industries . . . chemical, paper, textile, petroleum, foods, metals, etc. — utilities, hospitals — even the Atomic Energy Commission — have purchased one or more C-E Package Boilers, Type VP.

There's significance in that fact for you. It's quite likely that all of these buyers knew that there are many "package" boilers on the market. They probably knew, too, that most of them *look* pretty much alike. But they *bought* the VP — the package boiler with *extra* features. Could be that they liked the idea, too, of buying a *small* boiler from the same company that has designed and built many of the *largest* boilers in the world.

Why not look into this VP Boiler and its *extra* features? Let us send you Catalog VP 233 which describes it in detail. B-7128





RECENT PURCHASERS OF VP BOILERS

Aceitera "La Gloria", S.A.
Albemarle Paper Co.
American Bitumuls & Asphalt Co.
American Woolen Co.
Ames Textile Corp.
Anaconda Aluminum Co.
Ashland Oil & Refining Co., Inc., The
Bell Telephone Laboratories, Inc.
Cardinal Glennon Memorial Hospital
Central of Georgia Railway Co.
Colonial Print Works, Inc.
Commonwealth Edison Co.
Comp. Hulera Euzkadi, S.A.
Container Corp. of America
Du Pont de Nemours & Co., Inc., E. I.
Federal Sweets & Biscuit Co., Inc.
Ferro Stamping Machine
Gaylord Container Corp.
General Motors Interamerica Corp.
Hockmeyer Brothers, Inc.
Liquid Carbonic Corp.
Marinette Paper Co.
Mathieson Chemical Corp.
Mead Corp., The
New York Life Insurance Co.
Omaha Public Power District
Orangeburg Manufacturing Co.
Pan American Refining Corp.
Ponce Hospital Center
Smith, Inc., J. Howard
Southern Cotton Oil Co.
Standard Oil Co. of British Columbia
Sure-Seal Corp., The
U. S. Atomic Energy Commission
Waterfalls Tissue Corp.
Whitaker Cable Corp.

SPECIFICATIONS — VP BOILER

Capacity . . 4,000 to 30,000 pounds of steam per hour
Pressures . . . . . Up to 250 pounds per square inch
Temperature . . . . . No superheat
Fuel . . . . . Oil or gas
Erection . . . . . Completely shop-assembled
Foundation . . . . . Simple concrete slab

C-E

COMBUSTION ENGINEERING

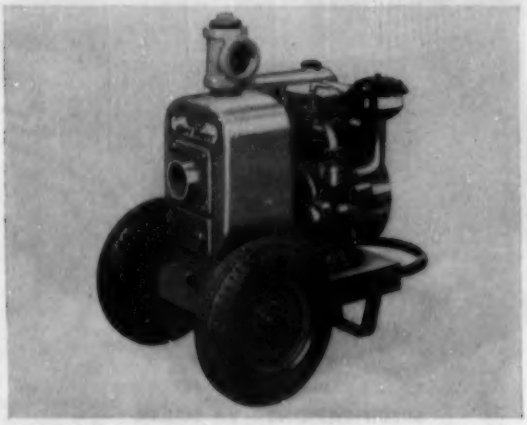
Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING AND RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS AND FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

Circle 509 on Reply Card for more data

Photo courtesy of Fort Worth Star-Telegram.

Don't let emergencies shut down your production



WORTHINGTON'S SELF-POWERED, SELF-PRIMING PORTABLE PUMP is ideally suited for emergency service in industrial floods, or for pumping from sumps or excavations. Size 20Y is shown.

A fast-acting Worthington emergency pump might have kept this plant operating

You can't always prevent an industrial flood, but you can often control it with a Worthington self-priming, self-powered portable pump. What's more, you'll probably be able to get the flood water cleaned up in time to keep production on schedule, too.

Especially designed for emergency service, these centrifugal pumps are self-powered for use in the event of electrical failure. They're portable and self-priming, too, so they can go into action immediately when needed. And they have suction lifts up to 25 feet at sea level for removing floor water trapped in sumps, pits, ditches, trenches or other excavations.

The Worthington self-priming portable pump line includes seven units with ratings of 4,000 to 42,000 gallons per hour. Write for complete information to Worthington Corporation, Centrifugal Pump Division, Section C.3.3, Harrison, New Jersey.

C.3.3

WORTHINGTON

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB

CENTRIFUGAL • ROTARY • STEAM • POWER • VERTICAL TURBINE

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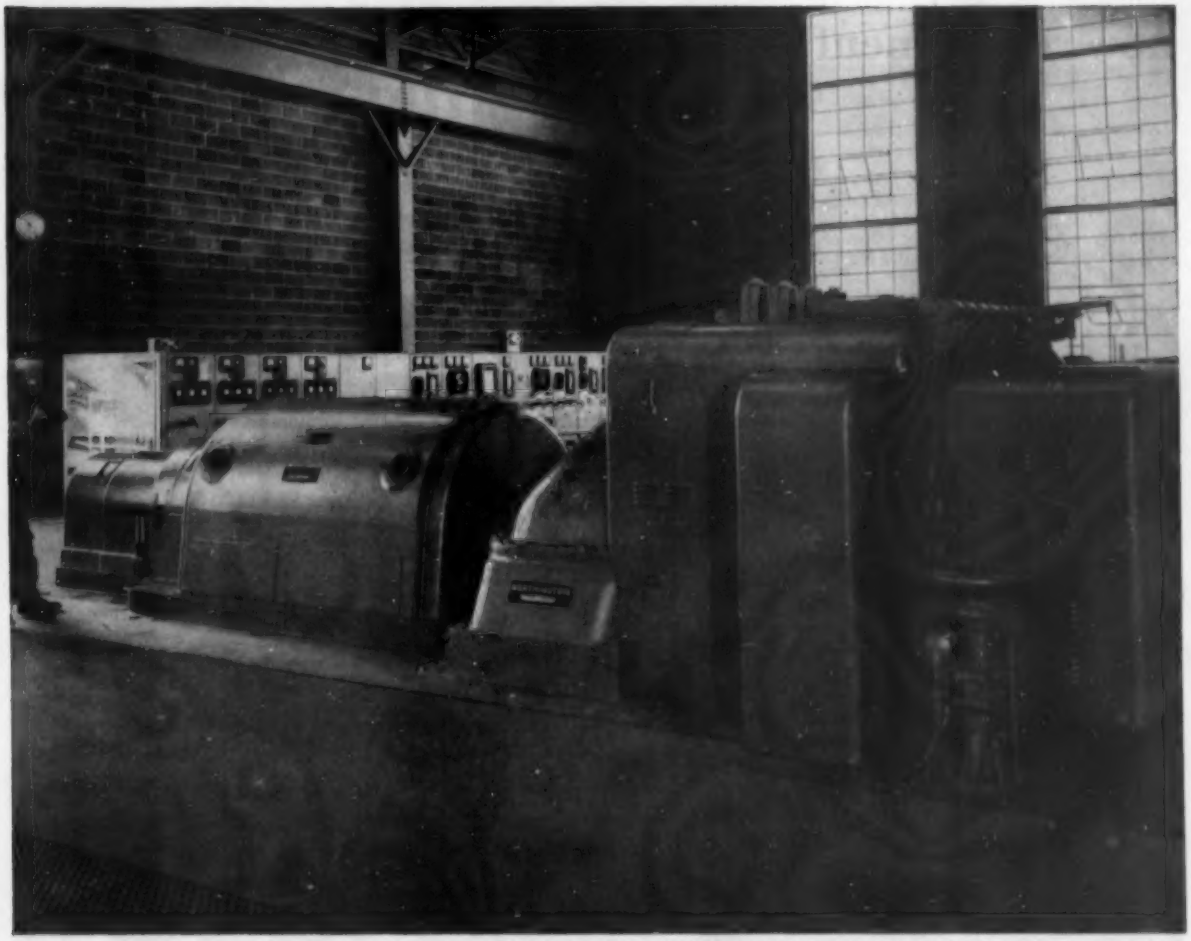


STREAMLINED WORTHINGTON TURBINE at Iowa State has provision for steam extraction for heating, laboratory, and process purposes throughout the college.

Iowa State completes modern power plant

With the installation of a streamlined Worthington turbine-generator, Iowa State College, in Ames, Iowa, has completed the modernization of its power plant. The use of heavy gauge lagging covers with rounded corners is responsible for the good looks of the modern Worthington unit.

Rated at 3000 kw, the Worthington turbine-generator is of the condensing-extracting type and operates on steam at 240 psi. The unit is designed for conversion to 400 psi, in case the college decides to go to the higher pressure.

By installing a Worthington turbine-generator, Iowa State benefited by the undivided responsibility that goes with turbine-generators designed, assembled and tested as complete units *before* shipment.

Find out how Worthington turbine-generators pay off in longer, more economical service. Sizes up to 11,500 kw. Get in touch with your nearest Worthington district office for more information. Or write to Worthington Corporation, Steam Turbine Division, Section T.3.2, Wellsville, N. Y.

T.3.2

WORTHINGTON

A GREAT TEAM IN STEAM

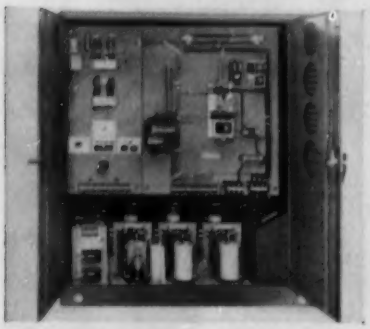
Single-Stage Turbines • **Multi-Stage Turbines** • **Turbine-Generator Sets** • **Feed Water Heaters** • **Boiler Feed Pumps** • **Surface Condensers**

Circle 511 on Reply Card for more data

new equipment

—Starts on page 8

cally no stretch, virtually eliminating belt matching problems. Made of all synthetic rubber, it is also oilproof, non-spark, and heat-resistant. A descriptive folder is available.



Mercury rectifier power drive is for adjustable-speed service

B30 Development of a mercury rectifier variable-voltage power drive designed for a broad range of industrial applications requiring adjustable-speed service is announced by the Reliance Electric & Engineering Co. The first size of the Xatron V-S drive available, operating in a three-phase bridge arrangement, provides conversion suitable for 30, 40, and 50-hp drives. The control units are substantially lighter in weight—and for 40 and 50-hp drives smaller in size—than control units including rotation conversion equipment.

Variable speed transmission is combined with magnetic clutch

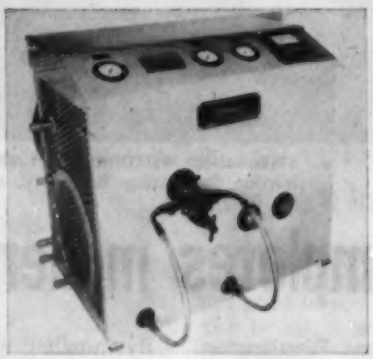
B31 No sudden starts or stops, controlled acceleration from zero to running speed, ease of handling fragile material, and smooth processing of other materials are features of the REEVES variable speed transmission when combined with an electro-magnetic clutch according to the manufacturer, Reeves Pulley Co. The rate of torque build-up is controlled automatically or manually, through the separate control panel that is furnished with this drive. Rate of acceleration may be adjusted for synchronizing motions, registering, or inspection. The electric clutch is now available on sizes No. 0, 1, 2, and 3, REEVES horizontal transmission.

Expansion compensators require no maintenance

B32 Expansion compensators for hot water and steam heating systems that are said to require no maintenance or adjustment and to stand up as long as the system of which they are a part have been developed by Flexonics Corporation. The device may be installed in low pressure steam or hot water lines carrying pressures to 40 psi and temperatures up to 250 F. It was especially designed for finned-type convectors, baseboard, radiator, or heating supply and return lines. Diameters of ¾, 1, 1¼, and 2 in. are available. One compensator will absorb expansion for up to 30 ft of copper tube, or 50 ft of steel pipe, depending on operating conditions.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.



Fully automatic operation possible with package type burner

B33 Sized for capacities to 42,000 lb steam per hr, the PK-54 burner, manufactured by the Peabody Engineering Corp., is a factory assembled unit combustion system for fully automatic operation. Each unit is engineered to meet a specific combustion problem. Various combinations for standard fuels and controls are available such as for oil only, gas only, oil and gas, and for fully automatic, semi-automatic, or manual operation. A bulletin gives further information.

Metallic bellows are heat and vibration resistant

B34 Titeflex, Inc., announces it is starting commercial production of its welded diaphragm type of metallic bellows in a variety of standard production sizes and in any one of several different metals. This construction is said to distribute flexing over the entire height of the convolution thus avoiding the concentration of flexing and the resultant work hardening that leads to bellows failure. The two types of belows using this new construction are the standard type, consisting of a series of male expansion elements and the nesting type, comprising a series of nesting male-and-female expansion elements for extreme flexibility applications.

Unit protects large generators

B35 Negative-sequence overcurrent relay (type COQ) for the protection of large generators is designed to initiate action to remove a generator from a faulted line when the damaging effect of negative-sequence current approaches the maximum allowed. Rated at 3 to 5 amp, 60 cycles, the COQ has taps at 3, 3.25, 3.5, 3.8, 4.2, 4.6 and 5.0 amp. A tap value corresponds to the current received from the auxiliary transformer secondary, which current in turn corresponds to 1.0 per unit negative-sequence current in the generator being protected. Relay characteristics are matched to generator characteristics by means of dial settings. The unit is available from Westinghouse Electric Corp.

Bolting of machinery is unnecessary with use of pads

B36 Use of anti-vibration floor pads bonded with Bakelite vinyl resins eliminates the need to bolt or cement heavy industrial equipment to floors. Re-usable, and less expensive than felt pads, they support up to 4000 lb per sq in. They are resistant to oils, grease, and alkalies. Vibrations of the machine cause the waffle-grid pad to grip the floor more firmly.

Air Casualties

It's bad air that does it. But you can step up production by putting a Coppus Blower on the job to keep the air moving — and keep the men cool.

The kind of air a man works in has a lot to do with how much work he can turn out.

In confined places like shipholds or tanks or drums or boilers . . . or wherever the air is stagnant or hot or full of fumes . . . a Coppus Blower is a *must* for getting first-class work out of the men, all the time.

A Coppus Blower or Exhauster helps avoid sickness and lassitude due to bad air . . . and improves morale, too.

Portable and adaptable for special purposes, Coppus Blowers and Exhausters will have dozens of uses around your plant. The "Blue Ribbon" (a blue painted band) is your assurance of quality performance at lowest cost.

COPPUS

BLUE RIBBON BLOWERS

THE BLOWERS THAT PUT MORE MINUTES IN EVERY MAN-HOUR

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 182 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuselages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets, etc., after treated with coating material.

NAME .....

COMPANY .....

ADDRESS .....

CITY .....

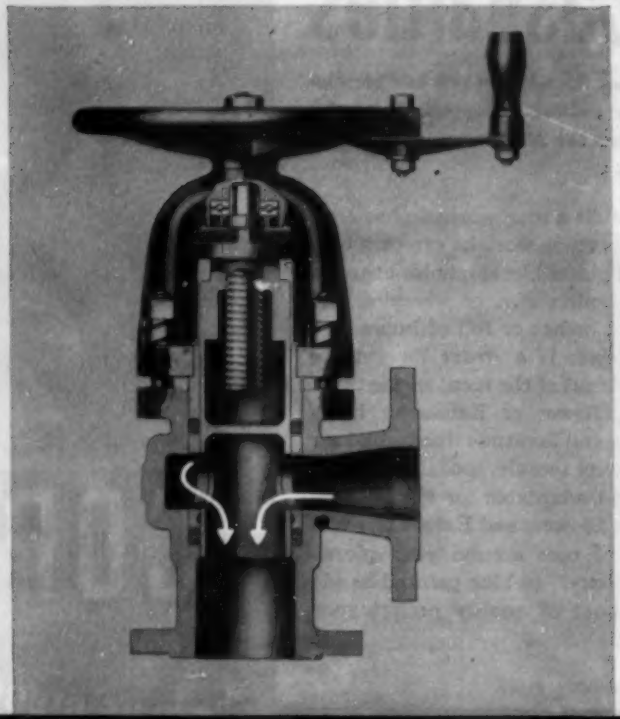
(Write here any special ventilating problem you may have.)

Circle 512 on Reply Card for more data

These YARWAY VALVE DESIGNS

YARWAY SEATLESS

Features balanced nitralloy hollow plunger that seals line drop-tight, yet permits free, unobstructed flow in blow-down. Other features —laminated packing, alemite lubrication, ball thrust bearings. USED SUCCESSFULLY IN OVER 15,000 BOILER PLANTS.



FOR LOW and MEDIUM PRESSURES

YARWAY HARD-SEAT

Features tough, stellite-faced and ground disc and seat ring, mated to provide smooth long-wearing surfaces. Stream-line flow. Alemite lubrication. MORE THAN 4 OUT OF 5 HIGH PRESSURE BOILER PLANTS USE YARWAY BLOW-OFF VALVES.

FOR HIGHER PRESSURES

USED IN OVER 15,000 BOILER PLANTS

serve every boiler blow-down need

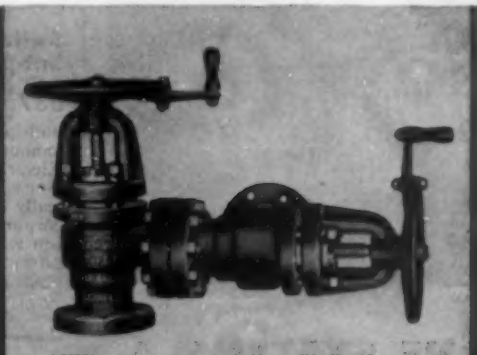
■ Whatever your *pressure* requirement, whatever your *piping* requirement—there's a Yarway Blow-Off Valve to exactly meet your needs.

Popular Yarway *seatless* design keeps blow-down lines drop-tight in low and medium pressure ranges. Sturdy Yarway *stellite seat and disc* design protects higher pressures.

All Yarway Blow-Off Valves are strong, rugged valves, built to withstand the punishment of regular or emergency blowing-down under full boiler pressure, and are available in metals that stand up under acid washing of boilers.

Write for new Yarway Blow-Off Valve Bulletins—B-426 (pressures to 400 psi) or B-434 (pressures to 2500 psi).

● Yarway Type S Seatless Blow-Off Valve, iron body for boiler pressures to 200 psi, steel bodies, for pressures to 400 psi. Angle valve shown, straightway available. Flanged connections. See Bulletin B-426.



● Yarway Type S Seatless Tandem Blow-Off Valve combining two angle valves. Other combinations available. Iron bodies for boiler pressures to 200 psi, steel bodies for pressures to 400 psi. See Bulletin B-426.

● Yarway Type C Seatless Tandem Blow-Off Valve combining angle and straightway valves. Other combinations available. Flanged or welding connections available. For boiler pressures to 600 psi. NOTE: When used in tandem with a Yarway Hard-Seat Valve, Type C Seatless may be used to 1500 psi. See Bulletin B-434.

LET YARWAY HELP SOLVE YOUR BOILER BLOW-DOWN PROBLEMS!

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY

blow-off valves

Circle 513 on Reply Card for more data

NEWS FROM Femco

AUDIOPHONE SYSTEMS

NOW! Brilliant new low-cost communication networks. You talk from control points to plant and between plant operations over as many mike-speaker stations as you need!

FIXED-POINT, WIRED COMMUNICATION

Users save time, money and energy. Production is increased, safety promoted and morale and efficiency improved.

EASY TO INSTALL!

Other Femco products of merit include:

PAGEPHONES

You page and converse anywhere in business or industry.

TROLLEYPHONES

Use carrier current over your existing power lines.

Ask for YOUR Femco Data Kit

FARMERS ENGINEERING
AND MANUFACTURING CO.
IRWIN, PENNSYLVANIA

Specialists in Electronic Communication and Control

Circle 514 on Reply Card for more data

new equipment

—Starts on page 8

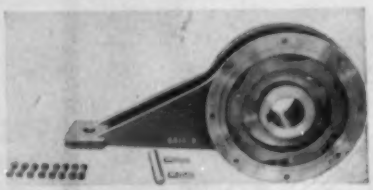
The Air-Loc 4-17-4 pads are supplied by the manufacturer, Clark-Cutler-McDermott Co., in pre-cut sizes, up to 32 in. sq.

Switch designed with lint-proof enclosure

B37 Size 0, across-the-line, manual starting switch for single or multiple shuttle textile looms has been announced by Arrow-Hart & Hegeman Electric Co. Known as type "LM" it is housed in a lint proof enclosure, is statically balanced to resist shocks, and incorporates an overload re-set mechanism which is said to provide maximum safety to machinery and personnel.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.



Unit prevents reversal of bucket elevators

B38 The Stephens-Adamson Manufacturing Company's enclosed roller type hold-back is designed to prevent reversal of bucket elevators and inclined conveyors due to power failure under load. The hold-back mounts directly on the drive shaft, with the torque arm bolted to a support with sufficient strength to resist the load exerted when reversal occurs. Maximum torque resistance ranges up to 350,000 in. lb for units with maximum bore 7 in. Bulletin is available.

Fuses are designed to protect industrial electric circuits

B39 Completely coordinated protection of low voltage electrical distribution systems in industrial plants is said to be possible by use of two types of fuses developed by Bussman Manufacturing Co. The fuses known as the Fusetron dual-element fuse and the Hi-Cap fuse, are designed not

The wheels of industry move on *power*—generated by power plants that must produce economically, be trouble-free and operate for long periods with a minimum of maintenance.

Efficiency of the boiler is vital . . . stacks must insure this efficiency with a minimum of heat loss, must guarantee predetermined draft production, must assure correct static pressure at all times.

Stack efficiency often means boiler efficiency. That's why many of America's most efficient power plants are Prat-Daniel equipped.

These power plants specified P-D Stacks because:
1. Breeching, fan and stack are built as *one* unit.
2. Losses due to breeching bends are eliminated.
3. Predetermined draft production can be guaranteed.
4. P-D stacks are designed to fit specific power needs.

In the design illustrated, for example, two fans are utilized for widely fluctuating loads. Each fan handles approximately 70% of total volume. Second fan may be automatically cut in. The one stack may be used on two boilers.

Our project engineers—The Thermix Corporation—are experts in fan-stack and flyash collection applications. Consult them for the answer to your draft problems. Ask them for the Prat-Daniel Fan Stack Catalog.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Quebec; Toronto 5, Ontario

Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks.

Circle 515 on Reply Card for more data

BEST OF ALL BONDING MORTARS
SUPER #3000
"The Wonder Cement"
BEST BY FAR
for Resistance to High or Low Temperatures
Successfully Used for
Bonding any fire brick, insulating refractory brick and other types of brick and shapes.
Abrasion-resistant covering over inside duct insulation.
Fan scroll covering over steel sheets as protection against erosion.
Painting tubes in boiler passes against erosion.
Protection of boiler tubes against fly ash.
Sealing wash coat over refractories.
Hot patching and many other uses where high heat is encountered.
Get the Facts on R&I Super #3000
Mail This Coupon Today
SUPER #3000
Sets Harder
Bonds Stronger
Lasts Longer under Severe Service
REFRACTORY & INSULATION CORP.
130 WALL STREET • NEW YORK 5, N.Y.
Send catalog on Super #3000 and name of nearest distributor
Name Title
Company
Address
City Zone State
Circle 516 on Reply Card for more data

new equipment

—Starts on page 8

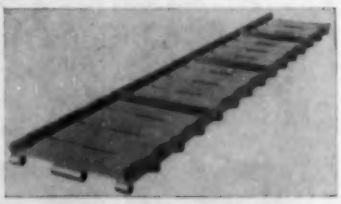
only for protection against fault current but to prevent interruptions on the circuit by high but harmless transient current, and differentiate between safe and harmful overloads. The Hi-Cap fuses are designed for systems up to 600 v, with sizes up to 5000 amp.

Butyl-molded transformer is for higher-voltage outdoor use

B40 Smaller and lighter than previous models, the Type JKW-3 butyl-molded transformer for outdoor applications to 5000 v, is said to represent the first successful application of the butyl process to transformers of the higher-voltage outdoor type. According to the General Electric Company's Meter and Instrument Dept., the previous maximum voltage for butyl-molded outdoor transformers was 600 v (Type JKP-O), although 5000 volts was the high for indoor use (Type JKM-3). The entire exposed surface of the transformer is completely corrosion-resistant.

TO REQUEST ADDITIONAL DATA

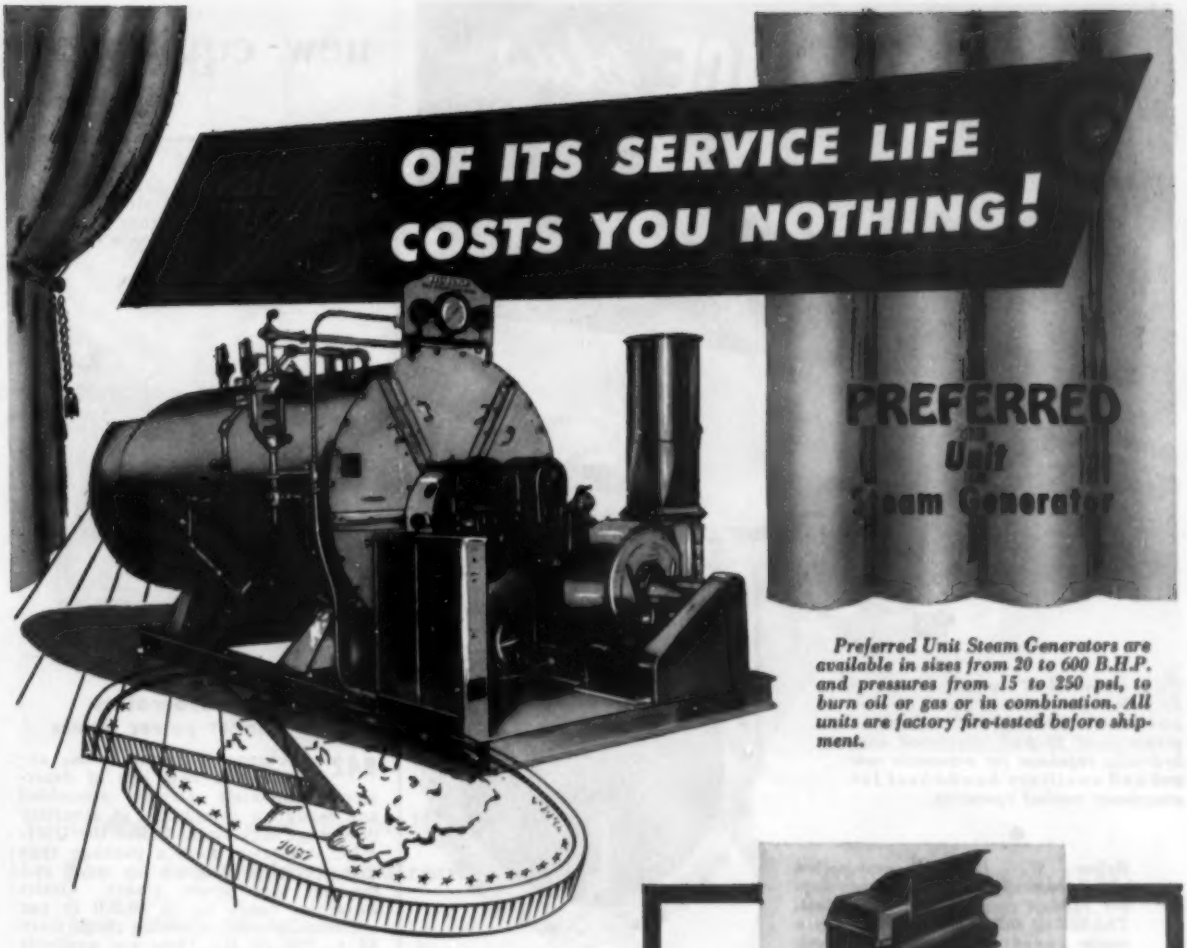
Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.



Line of piano-hinged apron conveyors is enlarged

B41 An augmented line of piano-hinged apron conveyors in three pan types, four chain pitches, and four basic assemblies, has been designed by Link-Belt Co. to meet a wide variety of conveyor applications. The pans are interlocked at the articulation point to provide a minimum of opening and a smooth joint, and to prevent material from seeping through. The tightness of the hinges reduces tendency to wedge or pinch materials being conveyed. In general, these conveyors are excellent for carrying materials horizontally, up and down inclines as steep as 45 degrees, and in combinations of these paths. Available in widths from 12 to 48 in.,

OF ITS SERVICE LIFE COSTS YOU NOTHING!



Preferred Unit Steam Generators are available in sizes from 20 to 600 B.H.P. and pressures from 15 to 250 psi, to burn oil or gas or in combination. All units are factory fire-tested before shipment.

The economies realized in sustained efficiency, fuel consumption and over-all maintenance and operating costs combine to make the Preferred Unit Steam Generator pay for itself in *less* than five years, amortization included. For more than four-fifths of its service life of at least twenty-five years it earns handsome dividends while it continues to deliver steam at the lowest possible over-all cost.

TEN DESIGN FEATURES MAKE THIS POSSIBLE

There are ten outstanding design features incorporated in each Preferred Unit. No other packaged boiler has *all ten* of these features. Their interrelated functions insure steam generation at the lowest possible cost by cutting maintenance costs of all kinds to the bone and by reducing fuel consumption by at least 10%.

STUDY THESE FEATURES IN CATALOG 2000

The function of each of these features in relation to the others and to the unit as a whole is covered in Catalog 2000. It shows why Preferred units pay such a worthwhile return on the investment. Write for it now.

PREFERRED'S ANTI-STRESS DECK

Prevents damage in the sheet area by maintaining the sections of the rear tube sheet above and below the water line in close balance. Unequal stress action is eliminated. The Anti-Stress Deck is one of the ten design features which insure long service life and low over-all maintenance and operating costs. Here are the other nine...

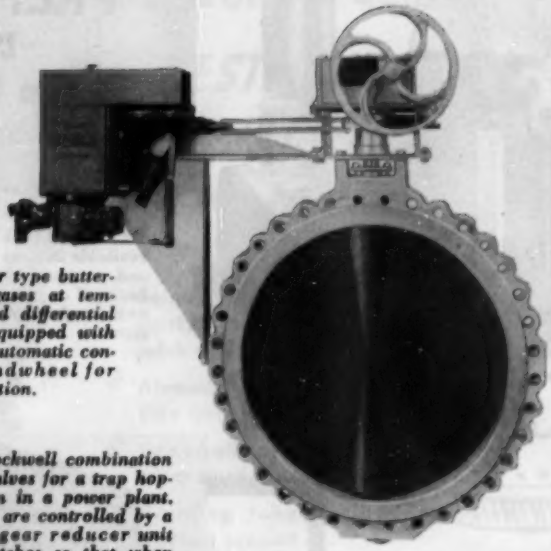
- Five Sq. Ft. of Heating Surface per Boiler HP
- Four Pass Gas Travel
- Down Draft Design
- Induced Draft
- Intermediate Furnace Position
- Expansile Precipitator
- Staggered Tubes
- Dual Purging Action
- Full Automatic Oil and/or Gas Burners

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY, NEW YORK 23, N. Y.
DEPT. SP-1

Circle 517 on Reply Card for more data

PERFORMANCE *plus*

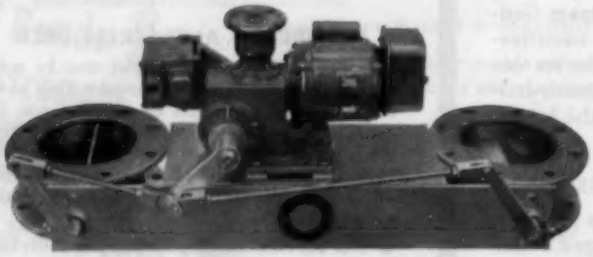
AUTOMATIC-MANUAL
VERSATILE
Control and Shut-Off



W. S. Rockwell 42" wafer type butterfly valve for exhaust gases at temperatures to 320° F. and differential pressures of 25 p.s.i. Equipped with hydraulic regulator for automatic control and auxiliary handwheel for emergency manual operation.

●

Below — W. S. Rockwell combination of two butterfly valves for a trap hopper exhaust system in a power plant. The linked valves are controlled by a motor operated gear reducer unit through limit switches so that when one valve is fully open, the other is fully closed.



For minimum pressure drop uniform quick control and positive shut-off—commercial, drip or air tight—W. S. Rockwell Valves are your answer. Sizes to 108"; pressures to 300 p.s.i., and higher, temperatures to 2000° F. Made of any metal or rubber lined. Write for Valve Catalog.

W. S. ROCKWELL VALVES

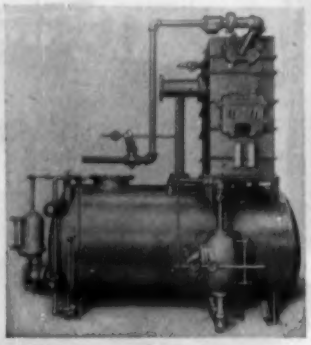
W. S. ROCKWELL COMPANY
2304 ELIOT ST. • FAIRFIELD, CONN.

Circle 518 on Reply Card for more data

new equipment

—Starts on page 8

they can be made in steel, stainless steel, aluminum, or other materials. More complete information is contained in a bulletin.



Package type deaerators are for smaller power plants

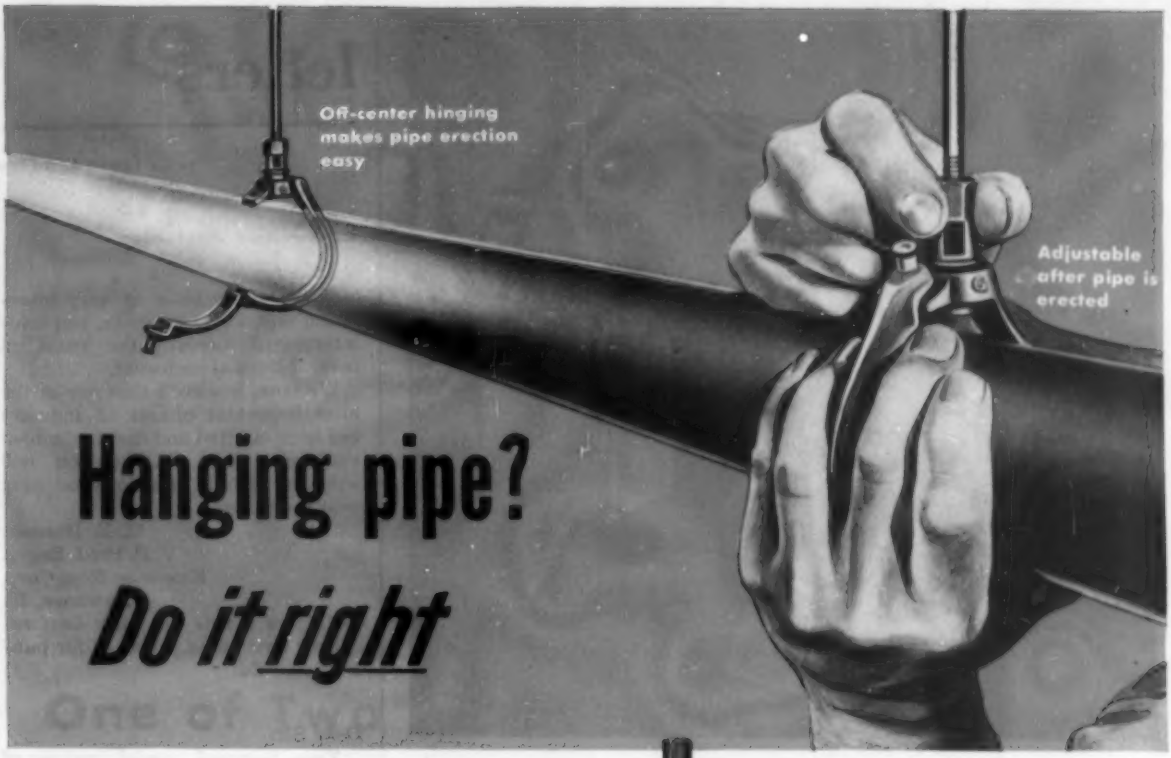
B42 Cochrane Corporation has announced a new line of deaerators completely factory assembled and ready for installation in a variety of storage tank sizes. Called the UNI-PAC deaerator, it is a package type unit specially designed for small and medium size power plants. Outlet capacities range up to 60,000 lb per hr; storage tank capacities range from 35 to 250 cu ft. They are available in both right and left hand types — the type being determined by location of steam inlet facing tray door. Literature is available.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.

Instrument furnishes permanent record of current and voltage

B43 Volt-ammeter Type CF-7 developed by General Electric Company's Meter and Instrument Dept., combines features of a self-latching multi-range hook-on current transformer and the simplicity of the Type CF inkless recorder in equipment suitable for indoor and outdoor applications. Ac can be measured and recorded on insulated or non-insulated conductors in circuits operating at potentials up to 8700 v. The waterproof equipment has current ranges of 15/75/150/750 amp, and voltage of 150/300/750 v for 50 or 60 cycle.



Hanging pipe?

Do it right

There's a stock Grinnell hanger for every piping requirement

SAVE MONEY ON ASSEMBLY. Cut installation time, get better, stronger installations, with Grinnell adjustable pipe hangers and supports.

NO SAG . . . NO WATER TRAP. Grinnell hangers permit adjustment after pipe is installed. This makes it possible to prevent sagging pipe and water traps, and assures positive drainage for the entire system.

FOR EVERY INSTALLATION. There is a stock Grinnell hanger for every need from simple water pipe to high pressure, high temperature steam line. Where necessary, there is a hanger to compensate for thermal movement.

PLAY SAFE. Don't waste time or take chances on inadequate pipe hangers and supports. All Grinnell hangers comply with rigid piping code requirements.

Enlarged section showing locking feature

GRINNELL ADJUSTABLE SWIVEL PIPE RING
(Split Ring Type)

- Hinging of ring is off-center. This provides sufficient seating to hold pipe before closing ring. Wedge-type pin is loosely but inseparably cast into the hinged section for fastening after pipe is in place.
- To obtain proper adjustment, swivel shank can be turned easily by hand when the weight of the pipe is temporarily taken off the ring.
- When weight is returned, patented swivel shank locks automatically, preventing change of adjustment due to vibration. Wire retaining ring keeps swivel shank and pipe ring or yoke from separating, makes assembly a single unit.
- 12 sizes have load range of 80 lbs. for ¾" size to 1510 lbs. for 8" size. May be used in connection with practically any building attachment.

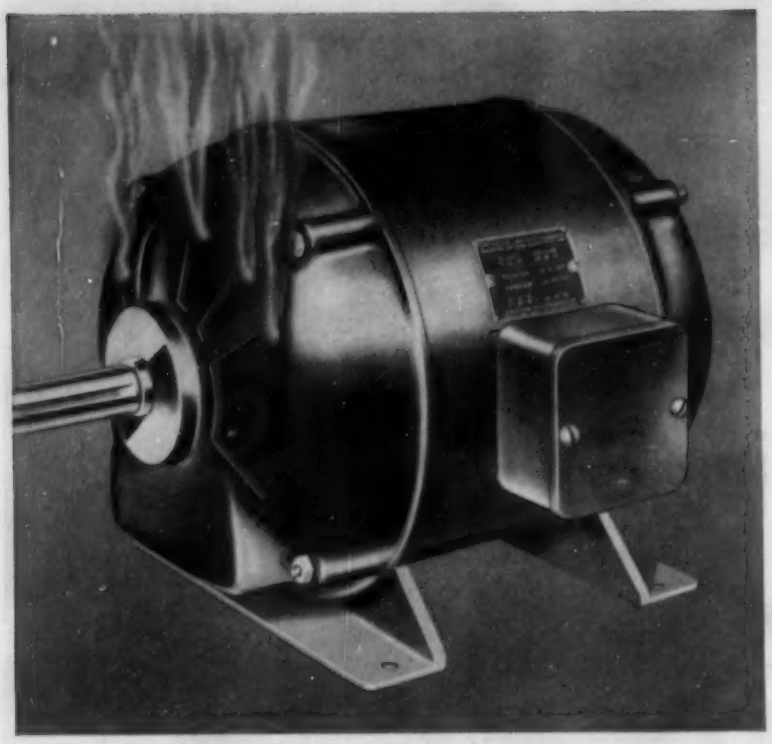
GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

Circle 519 on Reply Card for more data



You can avoid motor burnouts

THE temperature surrounding motor protection equipment is an important factor in motor burnouts. In order to prevent nuisance stoppages in hot weather, the rating of protective equipment is often raised. Then, when plant temperature drops, protection is inadequate . . . motors are more subject to burnout.

This explains why an ever-increasing number of plants are standardizing on HEINEMANN Circuit Breakers as manual motor controllers. Set tripping points of HEINEMANN Circuit Breakers *are completely independent of ambient temperature.*

Moreover, HEINEMANN Circuit Breakers provide inverse time delay to permit starting inrush or harmless, temporary overloads . . . yet they provide the fastest circuit interruption available on large overloads, stalled rotors, single-phasing or short circuits.

HEINEMANN Circuit Breakers operate on a hydraulic-magnetic principle. They do not employ thermal elements or heaters. They are available with precise ratings to the motor, and are provided with time delay characteristics especially suited to trouble-free motor protection.

don't use heat ... USE POWER

Send for Bulletin 1410.

HEINEMANN ELECTRIC CO.

140 PLUM STREET • TRENTON 2, NEW JERSEY

Circle 520 on Reply Card for more data

letters

. . . from readers

Review Issue Applauded

Gentlemen:

The January issue is very interesting and, in our opinion, you have interpreted correctly the trend in several lines of endeavor.

We note, however, that one of the most important phases of industry has been omitted and that is the heat exchanger field. Maybe you will want to include this in your next year's outline.

C. E. Bronson
V. P. Prod. Engrg.
Kewanee-Ross Corp.
Kewanee, Ill.

—Feature article on waste heat recovery now being prepared for publication.—Ed.

Dear Sir:

Your featured annual review of equipment developments will surely be of interest to anyone who may specify or purchase new equipment during 1954. I look forward to next year's annual report, a real service if you will continue it.

L. P. Bornwasser
Asst. Ch. Project Engr.
The Girdler Co.
Louisville, Ky.

Dear Sir:

The Industrial Development Review as contained in the January issue I find very interesting and also helpful. I would like to see this plan made an annual event.

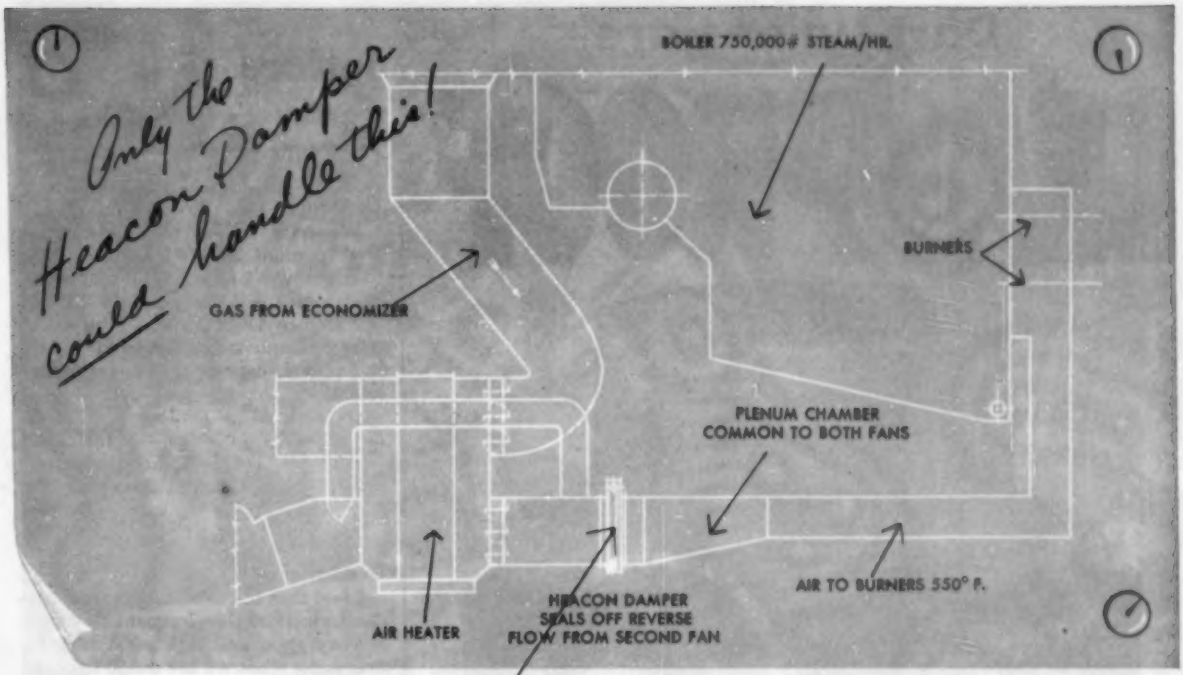
Al Frommer
Chief Engr.
Farmers Union Grain Terminal Assn.
St. Paul, Minn.

Dear Sir:

...I think you have compiled a real service to your readers and the plant information included should be carried on as an annual presentation. I find it of considerable value in showing the trend of the times.

INDUSTRY AND POWER is looked to each month with considerable interest and the articles are many times most helpful.

Paul R. Duffey
Chief Pwr. Engr.
Youngstown Sheet & Tube Co.
Youngstown, Ohio


Only the Heacon Damper could handle this!
BOILER 750,000# STEAM/HR.
BURNERS
GAS FROM ECONOMIZER
PLENUM CHAMBER COMMON TO BOTH FANS
AIR TO BURNERS 550° F.
HEACON DAMPER SEALS OFF REVERSE FLOW FROM SECOND FAN
AIR HEATER

One of Two Air Pre-Heaters cleaned *while* Boiler operates at half load

THERMIX HEACON

There's a big difference in temperature between the inlet and outlet sides of this Heacon Damper installation when the damper is closed. There has to be because in this large western utility, air pre-heaters are cleaned while the boiler operates at half load!

This is made possible only because Heacon Dampers can effectively shut off high temperatures without leakage . . . can assure safety of personnel while boiler is in operation.

No other damper could assure the tight sealing so necessary in this installation. No other damper could provide these important benefits:

1. Quick return on investment through savings realized by operating steam generator at one-half load or better during cleaning operation.
2. Elimination of internal strains and possible damage during complete boiler shut-down.
3. Safety of personnel during cleaning operation.

Performance will prove to you as it has for others that Heacon Dampers are the most efficient dampers available anywhere. *Performance* in this installation resulted in 6 repeat orders for a total of 25 dampers!

Heacon Dampers are designed and constructed to meet practically any pressure or temperature specification. Our engineers will be glad to discuss your damper problems with you.

Project Engineers

THE THERMIX CORPORATION
GREENWICH, CONN.

(OFFICES IN 38 PRINCIPAL CITIES)

Canadian Affiliates: T. C. Chown, Ltd. 1440 St. Catherine St. W., Montreal 25, Quebec. 983 Bay St., Toronto 5, Ontario, Canada

Circle 521 on Reply Card for more data

Dart Unions are

LEAKPROOF

This True Ball Joint Makes the Difference

You can't buy an *easier*-operating, *longer*-operating, more *positive*-operating union for *any* money

QUICK FACTS

- Leakproof because precision-machined to a true ball joint and spherically ground
- Extra wide bronze seats (Resist pitting and corrosion)
- Heavy shoulders (Take severe wrenching without harm)
- Nut and Body Practically Indestructible (They're air-refined, high test malleable iron)

See your supplier today

DART UNIONS

DART UNION COMPANY • PROVIDENCE 5, RHODE ISLAND

The Fairbanks Co. — Distributors: Boston • New York • Pittsburgh • Rome, Ga.

Circle 522 on Reply Card for more data

letters

—Starts on page 30

Dear Sir:

We wish to say that (Industrial Development Review) is something that you can't afford to discontinue. By all means it should be a yearly occurrence to bring this interesting data in condensed form to the reading public, especially to the engineers.

Joseph H. Beck
Plant Engr.
Fisher Body Div.
G. M. C. Stamping Plt.
Detroit

Gentlemen:

I feel that the article (Power Article, Industrial Development Review) is very good and is a great help in analyzing what we are doing in comparison to others.

R. L. Culbertson
Engineer
General Electric Co.
Erie, Pa.

Dear Sir:

We enjoyed reading the excellent article on "Materials Handling," beginning on page 56 of the January issue.

R. C. Sollenberger
Executive Vice President
Conveyor Equipment Mfgr's Assn.
Washington, D. C.

Combustion Chart

Gentlemen:

Please send me a copy of the combustion chart on page 30 of the December issue. Is it possible to get 16 copies for the members of a Pennsylvania State College course in fuels and combustion which I teach in evening school?

G. S. Reed
Hammermill Paper Co.
Erie, Pa.

Annual Index

Dear Sir:

If available, we would like to receive an annual index to the periodical, INDUSTRY AND POWER. This is for use in the Natural Gasoline Department Library.

R. C. Ringham
Phillips Petroleum Co.
Bartlesville, Okla.

INCREASE HORSEPOWER CAPACITY 40%

. . . and give you more use per dollar

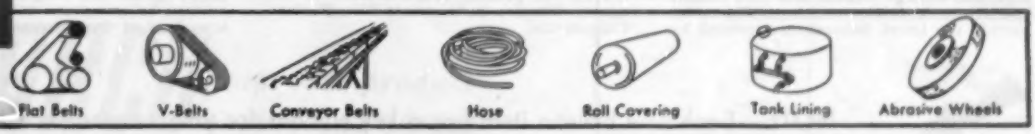
The combination of new synthetic fibers in the strength member of R/M Super-Power V-Belts assures greater resistance to shock loads, virtually no stretch, and practically eliminates matching problems. This, along with our straight side-walls, means better tensioning and grip, less slippage . . . more power delivered on the drive. Compared with regular V-belts you can handle approximately 40% greater load with the *same number* of R/M Super Power V-Belts or do an equal job with *fewer.*

Another plus . . . these V-belts are oil-proof, non-spark and heat-resistant. Send for Bulletin 6628. Ask the R/M distributor to show you how R/M Super-Power V-Belts will deliver "More Use per Dollar" on your drives . . . Condor V-Belts continue to be the standard for regular service.

RM

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Bowling Balls

Circle 523 on Reply Card for more data

new bulletins

. . . catalogs from leading manufacturers

200—Engines

The latest type of engine made by this company for operation on gas, as a diesel, or as a gas-diesel unit is described in 11-page booklet I-71. Complete engineering specifications and ratings are given in graph form along with space plans for diesel and gas-diesel and gas engines. The Cooper-Bessemer Corp.

201—Burner Equipment

The knowledge gained in 35 years of experience in solving both common and unusual burner problems is incorporated into the industrial oil and gas burner equipment described in 27-page booklet OB-53. The relative merits of steam versus mechanical atomization of oil is discussed. Conversion tables, cross-sections, and installation drawings and photographs are included. The Engineer Co.

202—Steam Measurement

In Application Memo K19 is described a typical installation of an engineered equipment package that makes possible the measurement of steam under widely different load conditions. The two-page sheet contains a schematic installation diagram, a complete description of the equipment used and its application, and cites advantages. Builders-Providence, Inc.

203—Heat Exchanger

Widespread application of the Paracoil boiler water sample cooler No. 75 gives timely importance to pamphlet 110. In addition to the design specifications, a set of charts are included to determine cooling water flow rate for various sample temperatures. Additional features include typical piping hookups and detailed instructions on the installation and operation of the cooler. Davis Engineering Corp.

LP Gas

Growing popularity of liquefied petroleum gas as an all purpose fuel, exemplified by its increasing use in recent years as a motor fuel, has prompted the safety engineers of the Association of Casualty and Surety Companies accident prevention department to publish 60-page pamphlet, "LP Gas—Safe Handling and Use." A compilation of information from eight pamphlets plus new material, this book gives tables and diagrams for use in computing maximum liquid volumes and filling densities for LP gas containers. It describes the composition, properties and behavior of the gas and also gives detailed information on its storage and handling at domestic, industrial, utility, and bulk distribution stations. **Copies may be obtained for 25¢ from the Association of Casualty and Surety Companies, 60 John St., N. Y. 38, N. Y.**

204—Packings

Documented with 45 mechanical drawings, this 60-page manual discusses leather and synthetic rubber packings. The tables include the latest dimensions approved by or recommended to the Joint Industry Conference. The three sections of the book cover: development, standardization, and types of hydraulic and pneumatic packings; dimensional data for leather cup, flange, U and V packs; and general properties and outstanding characteristics of natural and synthetic rubber packings. Graton & Knight Co., and International Packings Corp.

205—Condensers

Extensive engineering data on a complete range of sizes and types of refrigeration condensers for ammonia or freon is given in 37-page bulletin RC-2. Included are drawings and tables of specifications for each type. Henry Vogt Machine Co.

206—Automatic Controls

"REEVES Automatic Production Control Booklet," G-537, covers the complete line of automatic controls available on this company's variable speed drives. This 24-page booklet describes means of solving problems involving the control of tension, the control of acceleration and deceleration, velocity and peripheral speed, synchronization of one or more machines, and the maintaining of uniform temperature, pressure, liquid level, and flow. Schematic engineering tracings show how these controls can best be utilized to increase production. Reeves Pulley Co.

207—Dehydration

To meet the increased demand in engineering operations for small volumes of dry gases not warranting plant size installation, this company has developed the Hydryer, described in this seven-page booklet. Operation of the unit is explained by means of text and pictures. Tables give engineering data necessary for ordering. J. F. Pritchard & Co., Equipment Div.

208—Temperature Control

Eight-page bulletin F 6149 on temperature control systems will help in the selection of sensing elements and their correct use for the most satisfactory results. Instrument industry control terminology is given, as well as rules to follow in selecting the proper method of temperature control for process characteristics or reaction. Wheelco Instruments Div., Barber-Colman Co.

209—Hydraulic Pumps

Four-page bulletin DP-300 points out features and gives selection data for the complete line of this company's dual-vane hydraulic pumps. A series of technical drawings, cut-away photos, and performance data charts illustrates the features of the pumps. Dudco Div., New York Air Brake Co.

210—Valves

Technical bulletin W-7, eight pages, fully describes the solenoid operated valve used in steel mills, rubber plants, water works, processing mills, chemical plants, pulp and paper mills, and many other industrial concerns. It contains complete operating instructions along with detailed parts lists and dimensions. Golden-Anderson Valve Specialty Co.

211—Doors and Controls

Photographically illustrated with representative installations of warehouse, "electric eye" doors, and special problem doors and controls, eight-page bulletin "Electric Doorman" includes complete specifications, applications, and information on folding, swinging, sliding, overhead, and craneway doors. Blue prints, erection diagrams, selection tables, and construction features are shown along with necessary hardware and recommended control systems. It also describes this company's engineering service available to industrial, commercial, and residential users of doors and gates. Electric Power Door Co., Inc.

212—Electric Heaters

This revised catalog includes bulletins on this company's complete line of electric heating elements and equipment. The book is indexed by the type of heater and each section iincludes a discussion of the basic principles to keep in mind when selecting such a product. Engineering data is included. Industrial Engineering & Equipment Co.

213—Utility Heaters

Lightweight, horizontal discharge heaters for general purpose heating, embodying the Featherfin heating element with finned tubes of seamless drawn copper are described in this bulletin. Engineering data, with wiring and piping details are also included. L. J. Wing Mfg. Co.

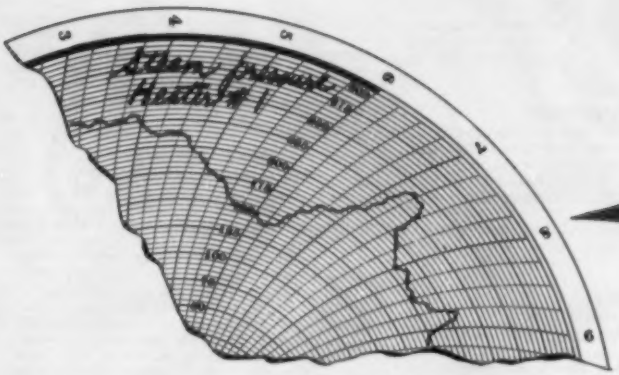
214—Heating Elements

Instructional manual 146 covers expected service life, operating temperatures (up to 2800 F), mounting methods, power consumption and electrical data, specifications, operating suggestions, and accessories for Crystolon heating elements. Engineering data in the 24-page booklet is in table and graph form for easy reference. Norton Company.

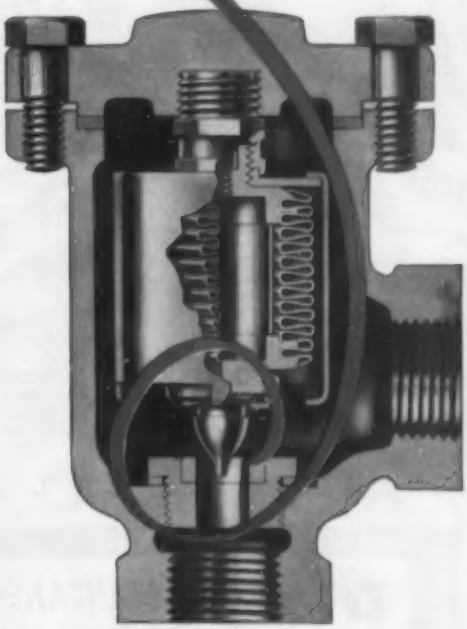
215—Gas Unit Heater

Twelve-page booklet 23-3 includes capacity tables and roughing-in dimensions, as well as structural and operational descriptions of this company's entire line of

NOTE—Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 34/35 & 98/99.



Same size seat and head for all pressures to 300 psi!



Is this your steam TRAPPING PROBLEM...

Changing seats and heads for varying loads or pressures to 300 psi?

HERE'S HOW to select the right trap!

First thing to do is to define exactly what you expect the trap to do—and then select 1 of the 5 *different* types best suited for the job on hand. If you need a trap with *one or all* of the following characteristics, then the Sarco Thermostatic Trap is your best bet.

1. No changing of seats and heads for varying loads or pressures to 300 psi . . . the thermostatic element is *self-adjusting*.
2. High capacity with small size (¾" trap fits palm of hand) . . . offers greatest capacity per dollar cost.
3. Large capacity air venting *regardless of steam pressure;* also freeze-proof, trap is wide open when cold.
4. Easy maintenance: bellows is only working part . . . can be removed, inspected and replaced in a few minutes.

HELPFUL BULLETIN: Send for Bulletin 145, "Selecting The Right TYPE Steam Trap." Gives characteristics of each type of trap and shows which type to use on various installations.

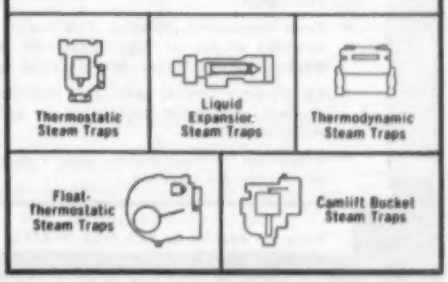
ENGINEERING SERVICE: Because only Sarco makes all five types of traps, Sarco can give you impartial advice on your trapping problems. Check your local Sarco sales representative next time a problem arises, or write Sarco Company, Inc., Empire State Building, New York 1, N. Y.

SARCO BALANCED PRESSURE THERMOSTATIC STEAM TRAP

Sizes ⅜" to 2", pressures to 300 psi. Write today for Bulletin 250.

Only Sarco Makes All 5 Types

. . . that's why Sarco can give impartial advice on trap selection



SARCO *improves product quality and output*

STEAM TRAPS • TEMPERATURE CONTROLLERS • STRAINERS • HEATING SPECIALTIES

Circle 524 on Reply Card for more data

new bulletins

—Starts on page 34

Series 23A gas-fired unit heaters, which range in capacity from 55,000 to 500,000 Btu per hr. Accessories are shown and selection suggestions given. United States Air Conditioning Corp.

216—Pressure Transmitter

Four-page bulletin A-707-A describes Type D2T Autronic Differential Pressure Transmitter in detail and gives data on principles of operation. It is illustrated with hook-up and schematic diagrams, phantom-cutaway views, and dimensional diagrams. Swartwout Company.

217—Construction

Engineering and construction activities of this company in the petroleum, chemical, and petrochemical fields are discussed in 24-page brochure RC8523. It contains photos and descriptive material on various applications of cooling towers, air-cooled heat exchangers, heavy duty mufflers, pulsation dampeners and gas cleaners in petroleum and petrochemical process plants. Fluor Corporation, Ltd.

218—Line Type Meter

A combination 1500-psi liquid line-flow measuring element and pneumatic flow-signal transmitter equipped with square root extraction cam for linear indication, recording, or control of furnace fuel and process liquids is described in four-page folder 2653. A cross-sectional drawing, color-keyed for clarity, and a blue print of outline dimensions are included. Hagon Corporation.

219—Electrical Equipment

Of importance to any person specifying or buying electrical control equipment, power transmission equipment, and electrical switchgear is this 16-page bulletin. It shows over 60 of the principal items of electrical equipment that are manufactured by this company. Complete captions are provided for each piece of equipment summarizing its function. Nelson Electric Manufacturing Co.

220—Flexible Metal Hose

Thirty-two page catalog 130R covers the full range of the company's Rex-Weld corrugated metal hose, Rex-Tube convoluted hose types, Rex-Flex stainless steel flexible metal hose, and numerous special purpose assemblies. Featured is new industrial Rex-Flex heavy duty stainless steel hose. Also covered are coupling types and installation information. Flexonics Corporation.

221—Water Hose

To help you select the best water hose for your specific need this four-page booklet contains photographs and cutaway sections of the various hoses as well as tables of sizes, working pressures, and weights. Hose constructions, lengths, couplings, and recommended applications are also included. Quaker Rubber Corp., Div. of H. K. Porter Co.

222—Corrosion Resistance

Designed to be of assistance to engineers involved in the selection of stainless tubing and pipe for corrosion resistance applications, eight-page bulletin TDC 100 contains information on the comparative corrosion resistance of stainless steels to corrosive media. It presents pertinent data on six widely used stainless tubing steels and several hundred corrosive media at various temperatures and concentrations. The Tubular Products Division of The Babcock & Wilcox Company.

223—pH Control Systems

Instrumentation Data Sheet 9.6-5a describes a complete system for continuous, automatic pH control of liquids in process including slurries, industrial wastes, and clarified solutions. The systems are specifically designed for use with dry chemical feeders and include pH electrode and amplifier assemblies and ElectroniK indicating and recording potentiometers with pneumatic control. A schematic diagram of one installation is included with illustrations of component parts. Minneapolis-Honeywell Regulator Co.

224—Tube Expanders

Ideal tube expanders made for every condition are described in eight-page fold-out 402. Specific uses for each type are given along with cross-sections showing the units in use. The Gustav Wiedeke Co.

225—Adjustable V-Belts

Veelos TD and TE adjustable V-belts for D and E belted drives which are said to materially reduce installation and operation costs on big drives, are fully illustrated and described in this eight-page catalog. Studs, cup-washers, and T-screws are pictured in detail along with the installation and operation characteristics. Manheim Manufacturing & Belting Co.

226—Blow-Off Valves

According to 23-page bulletin B-433, good manually-operated blow-off valves are

Pick INSTANTANEOUS HOT WATER HEATERS
ENGINEERED FOR SERVICE

Industries everywhere are replacing outmoded water heaters with Pick Instantaneous Water Heaters. Here are the reasons:

★ Water Is Heated Instantly. Entirely automatic, Pick Heaters operate by steam injection to heat the water in a flash to exact temperature desired and in volume required.

★ Fuel Savings Are Substantial. Steam injection heating is the most efficient method known. There's no waste because water is heated only as used . . . never stored and allowed to cool.

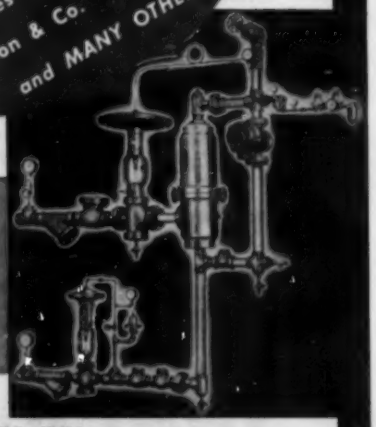
★ No Storage Tanks Required. Compact design of Pick Heaters permits out-of-the-way installation in corners, on walls or overhead. Saves valuable floor space.

★ Exact Temperature Control. Pick heaters can be operated at low or high loads with minimum temperature fluctuation. And it's done quietly.

★ Maintenance Cost Is Low. Pick Heaters can be cleaned in a matter of minutes — worn parts easily replaced.

★ Installation Is Inexpensive. Only ordinary pipe connections are required.

PICK HOT WATER HEATERS . . . Used by
• United States Steel Co.
• Ford Motor Co.
• H. J. Heinz
• Bethlehem Steel Corp.
• Hercules Powder
• Wilson & Co.
and MANY OTHERS



Pick STEAM INJECTION WATER HEATERS

SAVES MONEY FOR ANY INDUSTRY THAT USES HOT WATER!

Write for booklet on how PICK HEATERS cut costs of Hot Water — No Obligation. Write IP-154

PICK MANUFACTURING CO. • WEST BEND, WIS.

Circle 525 on Reply Card for more data

THIS IS THE MOTOR of a production grinder. Note dust and coolant on SEALTITE protecting lead wiring.

How to keep foul-up and corrosion out of your lead wiring

Use SEALTITE. Its tough outer cover resists all enemies of motor lead wiring.

You can spray your wiring with oil . . . douse it in water . . . cover it with dirt . . . expose it to corrosive fumes . . . even let salt spray and chemicals do their worst—*without fear of foul-up and corrosion*—IF you run it in SEALTITE* Electrical Conduit. A special outer cover takes them all in stride.

Yet tough as it is, SEALTITE is light and flexible. It installs easily in cramped spaces. It absorbs vibration—takes movement. It hugs motor contours. It looks neat.

*Trademark

Liquid-tight SEALTITE is the first conduit of its type to be approved by Underwriters' Laboratories, Inc. for use where exposed to moisture and mineral oils. (See N.E. Code, Art. 351.) For tight bends on machine tools and industrial equipment, use SEALTITE Type EF (Extra Flexible), which meets standards set by J. I. C.

Electrical Supply Houses stock both types in coils. Buy it this way; then cut without waste. Jobbers also stock liquid-tight fittings for use with SEALTITE.

SEALTITE
flexible, liquid-tight electrical conduit
as ANACONDA® product

The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.

Please send me descriptive booklets on SEALTITE Electrical Wiring Conduit. 54171

NAME..... TITLE .....
(PLEASE PRINT)

COMPANY.....

STREET.....

CITY..... ZONE..... STATE.....

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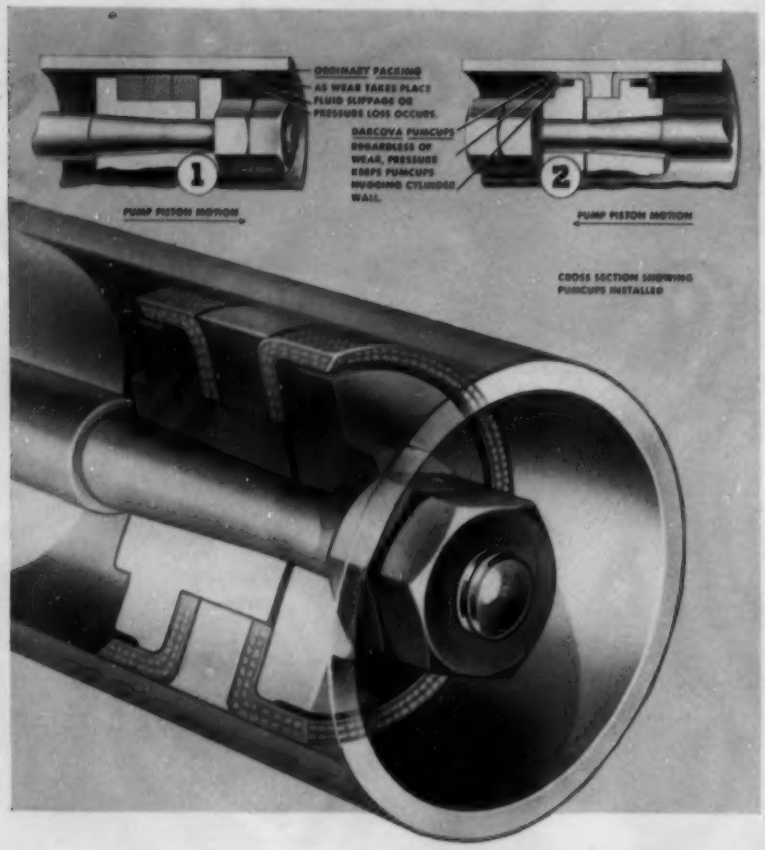


DARCOVA PUMCUPS mean EFFICIENCY to cost-minded engineers!

IN air and hydraulic cylinders and reciprocating pumps Darcova Pumcups actually retain full efficiency *throughout* their life span . . . and they outlast most other packings at least 3 to 1!

Special texture engineering plus the Darcova Pumcup principle makes it possible for Pumcups to hold their peak volumetric efficiency. Moreover, Pumcups permit equipment to be operated at reduced speeds, save power, prolong equipment life and eliminate the need for frequent replacement shutdowns.

For less maintenance and lower operating costs find out more about Darcova Pumcups. Write for Bulletin No. 4502 on Pumcups for air or hydraulic mechanisms, Bulletin No. 4401 on Pumcups for reciprocating pumps.

DARLING VALVE & MANUFACTURING CO.
Williamsport 9, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

Circle 527 on Reply Card for more data

new bulletins

—Starts on page 34

necessary to insure adequate removal of suspended solids even under modern conditions of high operating pressures with continuous blow-down systems. Details covering two types of Yarway blow-off valves for working steam pressures from 400 to 2500 lb are given: the sliding plunger type, and the metal-to-metal seat-and-disc type. Yarnall-Waring Co.

227—Gages and Valves

Liquid level gages, valves, and specialties for chemical and petro-chemical processing, developed through years of working closely with men in the field, are the subject of four-page folder 218. Recommendations are given as to use and operation and many of the types of gages are pictured. Jerguson Gage & Valve Co.

228—Vaneaxial Blowers

Direct-drive vaneaxial blowers, three types of belt-drive vaneaxial blowers, and a special portable blower for exhausting fumes from tanks are described in 16-page bulletin A-110. Included are dimension drawings and figures and complete air delivery tables for all of these blowers. Two of the belt-drive models, a high-temperature blower, and a new design for low volume, high pressure requirements, are new lines which have not been shown in any previous catalog by this company. Hartzell Propeller Fan Company.

Power Plant Cleaning

Based on actual in-plant experience of this company's large staff of technical service representatives, 42-page handbook, "How to Make Power Plant Cleaning Easier," discusses the most common cleaning, descaling, and paint stripping problems. It is conveniently divided into sections on cleaning equipment in steam central stations, diesel, and electric power plants. **Please send requests directly to Oakite Products, Inc., 137 Rector St., N. Y. 6, on your company letterhead.**

229—Outdoor Service Equipment

Designed to make easier the selection of outdoor service equipment, 12-page bulletin 2016 combines descriptive data on all available standard equipment—service entrance, receptacle type, dual control, three-phase units. Typical assemblies of circuit breakers and the various enclosures are listed for each type of equipment. Also included is a comprehensive guide to this company's line, showing catalog numbers, hub sizes, voltages, ampere ratings, and other specifications. Heinemann Electric.

230—Blast Cleaning

"Blast Cleaning," a 32-page booklet written by Victor F. Stine, vice president of this company supplies information to anyone who would like to know more about the possibilities of blast cleaning in his field. A comprehensive list of applications is furnished along with a glossary defining the terms used in the book. Pangborn Corp.

231—Controlled Closing Valves

This six-page bulletin describes Type CCAV controlled closing valve which was designed to overcome the problems of surge and water hammer damage. Outline drawings of the unit as well as a complete description of its primary purpose, design characteristics, and supplemental uses are given. Simplex Valve and Meter Co.

(Continued on page 100)

measure oxygen direct

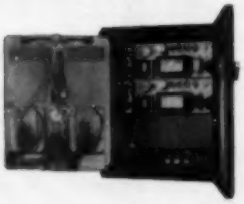
paramagnetic method of measurement extremely accurate in analyzing industrial gases

Oxygen is unique among other common gases in that it is highly paramagnetic (attracted into a magnetic field). This property of oxygen is the basis of the operation of the Hays Magno-Therm Analyzer in the analysis of industrial gases.

application

Hundreds of companies are using the Hays Magno-Therm O_2 Analyzer and Recorder in applications from revivification of SO_2 removers in manufactured gas industry and regeneration of catalysts in oil refineries to mixing air with propane to get substitute fuel. Boiler plants use it as a combustion guide because it is the only means of getting an undistorted picture of excess air.

Write today for bulletin 52-829-56 and get complete details.



ANALYZER	RECORDER
Highly sensitive to changes in oxygen content.	Self-balancing bridge circuit assures accurate, permanent calibration.
Rapid response to changes in oxygen content.	Electronic amplifier has no moving parts. High sensitivity. Rugged.
No liquid or gaseous fuel required to be added to gas sample.	Immediate response—analyzer is continuously connected to recording pen drive motor.
No chemicals required.	As many as four analyses can be recorded on the same chart.
High accuracy maintained.	Range can be changed easily in the field.
Not affected by wide variation in rate of flow of gas sample.	Isolating transformer for each amplifier removes line interference from bridge circuit.
Rugged construction. No delicate or moving parts.	Extra slide wire available for control, remote indication—for recorder or contacts for alarm circuit.
Easily installed — no special fittings required.	

Automatic Combustion Control Boiler Panels • CO_2 Recorders Veriflow Meters and Veritrol Gas Analyzers • Draft Gages Combustion Test Sets Electronic Oxygen Recorders Electronic Flowmeters Electronic Feed Water Controls Miniature Remote Indicators

THE hays CORPORATION

MICHIGAN CITY 2, INDIANA

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6 OF THE MANY McALEAR CONTROL GUARDSMEN

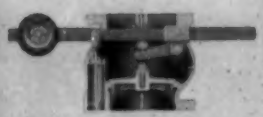
Pilot-operated pressure reducing valve for accurate control of reduced pressures . . . single seated closed valve affording dead end service.

Stop and check control — used with two or more boilers — automatic safeguard against reverse steam flow.

Suction and pressure type strainer —clamped or bolted cover—adaptable to any strainer service.

Self-cleaning "Y" strainer — used to protect regulators, pumps and traps by removing foreign matter from the line.

Feed water regulator—used for continuous feed to boiler to maintain water level. Has mercury cut-out switch as additional safeguard in case of low water.



Back pressure valve—Single seated vertical type . . . efficient—noiseless. Operates with condensing and non-condensing engines.

You can forget control problems if you REMEMBER McALEAR

There's a safe way to forget all about your control problems—just remember McALEAR. For when you use McALEAR controls you benefit from a background of fifty years of experience covering every type of installation. You know you have controls engineered to an exactness . . . controls that are just right for the specific job. You can depend on McALEAR because (1) There is an expert engineering service behind every product; (2) McALEAR sales representatives are hand picked for control know-how; (3) McALEAR controls are available through leading plumbing and heating wholesalers.

McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL-GAS

McAlear Manufacturing Company
1901-1919 South Western Avenue
Chicago 8, Ill., U.S.A. 885-DW

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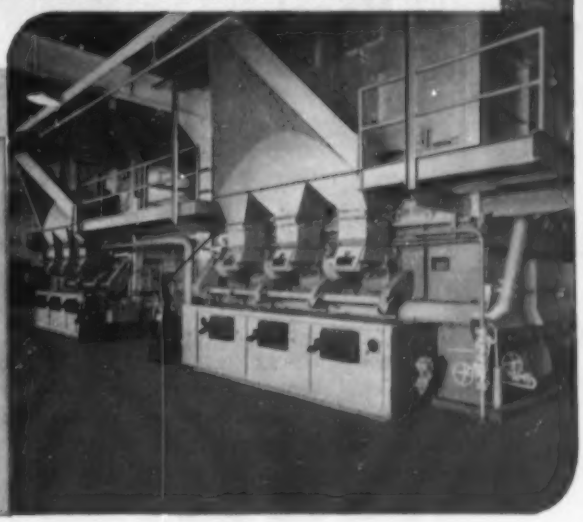
NEW PLANTS LIKE CATERPILLAR'S BURN COAL THE MODERN WAY!

Mr. R. H. Bachman,
Plant Maintenance Engineer,
Caterpillar Tractor Co., says:

"Our new plant pictured above was recently completed at Joliet, Illinois. A completely up-to-date coal installation was chosen to handle the heat and process steam requirements. To the right is a picture of the firing aisle showing how the boilers are fed by dust-tight chutes from overhead bunkers. This modern equipment makes coal as clean, convenient, and efficient as a fuel can be! The boilers are rated at 80,000 lbs. of steam per hour, but have handled loads as low as 3,000 lbs. per hour without difficulty."



For big savings, build for COAL! That's a good rule to follow whether you've got a new plant under construction or an older plant being modernized.

Up-to-date coal-burning equipment can give you more steam per dollar . . . modern coal- and ash-handling systems can cut labor costs to a minimum. In addition, coal is the only fuel with virtually inexhaustible reserves. And to mine this coal, to better prepare it for customers' special needs, America has the world's most productive coal industry. Thus, coal users get a double advantage—*dependable supply of an even better product, at relatively more stable prices.*

For heat, power, process steam—coal is your best bet! Ask a consulting engineer. He'll show you how to cut both fuel and operating costs by burning coal in a modern plant designed to meet your specific needs.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY ★ FOR LOW COST

YOU CAN COUNT ON COAL!

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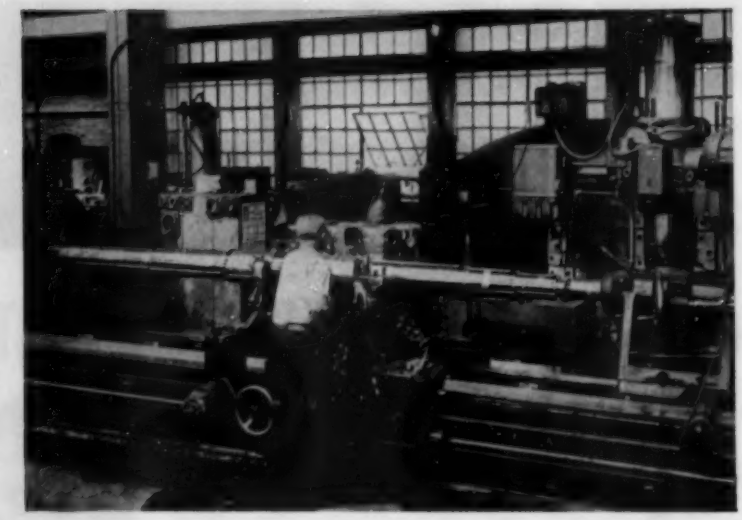
When you need a tough, fatigue- and corrosion-resisting alloy —try "K" Monel



This is one of the largest INCO Nickel Alloy pump shafts in the world. The shaft is 13 feet 7⅛ inches long, 9.005 inches at its widest diameter, and weighs 3,343 lbs. It was forged by INCO'S Huntington Mill from "K" Monel for Consolidated Edison Co., after other materials repeatedly failed.

Are there applications in your operation where metal is subject to fatigue, corrosion and erosion?

Then chances are "K" Monel is the alloy you need.

"K" Monel is a tough, corrosion-resisting wrought alloy of nickel, copper and aluminum. It offers you the excellent corrosion resistance of regular Monel, together with the added advantages of greater stiffness and hardness through heat-treating.

As evidence of the value of "K" Monel's added advantages, take a pump shaft operating in highly corrosive and polluted salt water.

New York City's Consolidated Edison Company has two big 80,000-gallon-per-minute condenser circulating water pumps. For years engineers kept replacing the shafts with materials of increasing strength but failures would continue to occur in the same spot because of corrosion fatigue.

Finally, they decided to try "K" Monel.

A 1½-ton heat-treated "K" Monel shaft with a tensile strength of 140,000 pounds per square inch was installed in September of 1949 and has been functioning perfectly ever since. In fact, the pump casing has not even been opened for inspection since installation.

Let's take a quick look at a few of the principal characteristics of "K" Monel:

Age-hardenable, or capable of having its hardness and mechanical properties increased simultaneously as the result of thermal treatment, "K" Monel is equal in strength and toughness to many heat-treated alloy steels. It shows improved strength and hardness at sub-zero temperatures with no loss of toughness. And it provides moderate strength at temperatures up to 900° F.

"K" Monel is non-magnetic under ordinary conditions, and remains so down to −150° F.

The working characteristics of "K" Monel are excellent, too. It is readily machined in an annealed condition, but in other conditions may be considered commercially machinable at practical (although generally somewhat slower) rates. It can be joined by the usual welding, brazing and soldering processes.

You'll find all essential engineering data on "K" Monel and its more machinable companion alloy, "KR" Monel, in the 24-page reference manual, "Engineering Properties of 'K' Monel and 'KR' Monel." Write for a copy so you'll have one handy when you need it. And any time you want help in solving a metal problem, get in touch with Inco's Technical Service Section.

The International Nickel Company, Inc.

67 Wall Street, New York 5, N. Y.

Inco Nickel Alloys

INCO

MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • INCONEL®
INCONEL "X"® • INCONEL "W"® • INCOLOY®
NIMONIC® Alloys • NICKEL • LOW CARBON NICKEL
DURANICKEL®

Circle 531 on Reply Card for more data

Circle 532 on Reply Card for more data →

For power from steam
DEALKALIZE WITH
AMBERLITE
IRA-410
Without Acids or Degasifiers*
Here are the facts about dealkalization with AMBERLITE IRA-410:
1. Alkalinity of water supplies for boiler feed and evaporator coolers may be conveniently controlled at low cost.
2. No acid-resistant or degasification equipment is necessary.
3. Because line pressure is not broken, pumping costs are eliminated.
4. Only low cost salt is required for regeneration—3 to 4 lb. per cubic foot of resin.
5. Combinations of the anion exchanger, AMBERLITE IRA-410, and the cation exchanger, AMBERLITE IR-120, permit simultaneous softening and dealkalization in a single column.
For more information about dealkalization with AMBERLITE IRA-410, write Dept. IP-1 for complete literature. For bi-monthly reports on new developments in ion exchange, ask to receive AMBER-HI-LITES.
CHEMICALS
FOR INDUSTRY
ROHM & HAAS COMPANY
THE RESINOUS PRODUCTS DIVISION
Washington Square, Philadelphia 5, Pa.
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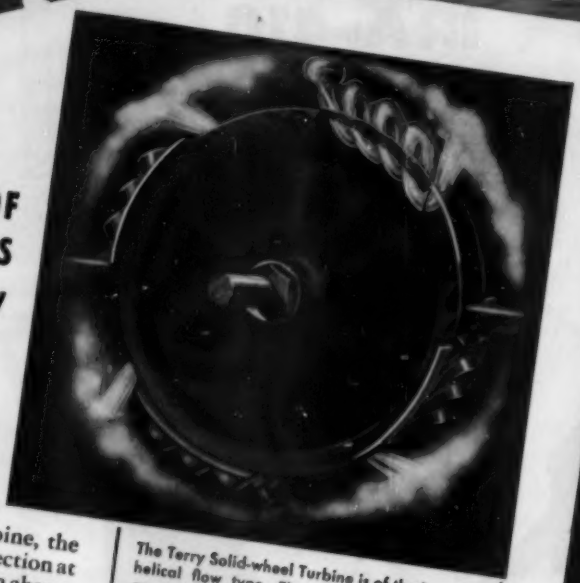
AMBERLITE is a trademark, Reg. U. S. Pat. Off. and in principal foreign countries.

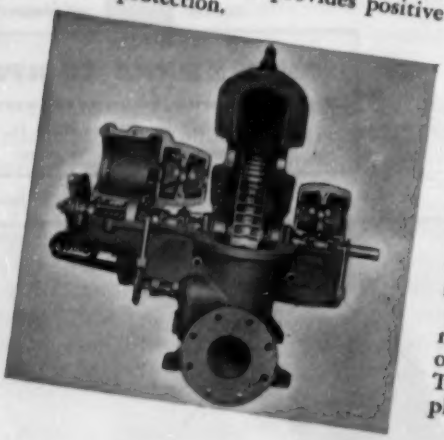
TERRY

PROTECTION OF TURBINE BLADES made possible by nozzle location



The Terry Solid-wheel Turbine is of the impulse, helical flow type. The steam issues from an expanding nozzle at high velocity and enters the wheel bucket where its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is returned to the wheel several times until practically all of the energy has been utilized. This principle makes possible the efficient use of steam in a single-piece, almost indestructible wheel.

In the Terry Solid-wheel Turbine, the steam enters the buckets in a direction at right angles to the shaft, as shown above. This design eliminates the need for close clearances and provides positive blade protection.



The blades cannot foul. There is a one inch clearance on either side of the wheel. In addition, projecting rims on each side of the buckets prevent damage to the blades even though external thrust should move the wheel.

This is only one of the many important features of the Terry Solid-wheel Turbine. Write for complete details.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1195

Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

Circle 533 on Reply Card for more data

Heat in a Hurry-at Low Cost!

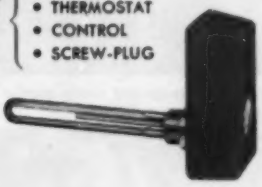
CHROMALOX

Pre-engineered PACKAGED Electric Heaters

COMPLETE HEATING UNITS READY FOR YOUR JOBS—FROM THE WORLD'S LARGEST STOCK OF STANDARD EQUIPMENT

ARTM Automatic Immersion Heaters

BUILT IN
- ELEMENTS
- THERMOSTAT
- CONTROL
- SCREW-PLUG

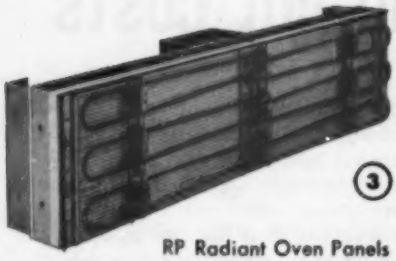


1

NWH Automatic Circulation Heaters

BUILT IN
- ELEMENTS
- THERMOSTAT
- HEATING CHAMBER
- INSULATION
- MOUNTING LUGS

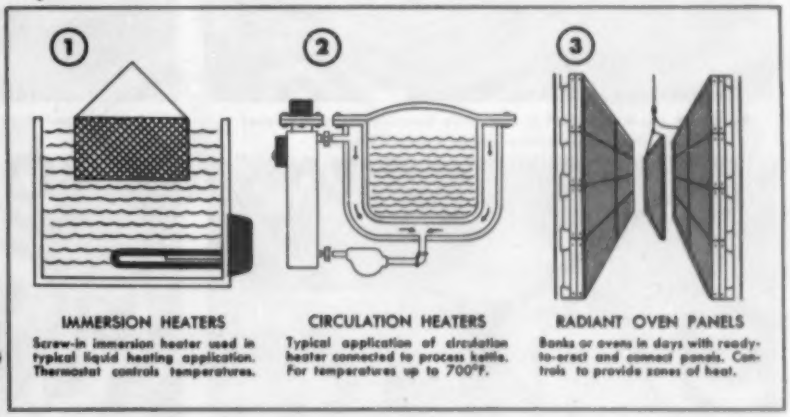
2



3

RP Radiant Oven Panels

BUILT IN
- STEEL FRAME
- METAL SHEATHED ELEMENTS
- REFLECTORS
- PREHEATING AIRWAYS
- INSULATION
- BUS BARS



IMMERSION HEATERS
Screw-in immersion heater used in typical liquid heating application. Thermostat controls temperatures.

CIRCULATION HEATERS
Typical application of circulation heater connected to process kettle. For temperatures up to 700°F.

RADIANT OVEN PANELS
Banks or ovens in days with ready-to-erect and connect panels. Controls to provide zones of heat.

CHROMALOX PACKAGED ELECTRIC HEATERS are ready to go to work on the heating jobs in your plant. Easy to install, they may be used as permanent or portable heat sources to give you clean, dependable, accurately controlled heat at temperatures required. Heaters are available for degreasing, cleaning, pickling and plating; for melting greases, asphalts and similar viscous fluids; for heating air and other gases; and for preheating fuel oils and superheating steam.

Nationwide application assistance, plus immediate delivery from the world's largest stock of electric heating equipment.

GET MORE DETAILS
SEND COUPON TODAY

IC-75

EDWIN L. WIEGAND COMPANY, Industrial Division
7520 Thomas Boulevard, Pittsburgh 8, Pa.

☐ Please send me Chromalox Catalog 50.
☐ Have a Chromalox Application Engineer get in touch with me.

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Company_____
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CHROMALOX

Electric Heat for Modern Industry

DESIGNERS AND MANUFACTURERS OF ELECTRIC HEATING UNITS EXCLUSIVELY SINCE 1917

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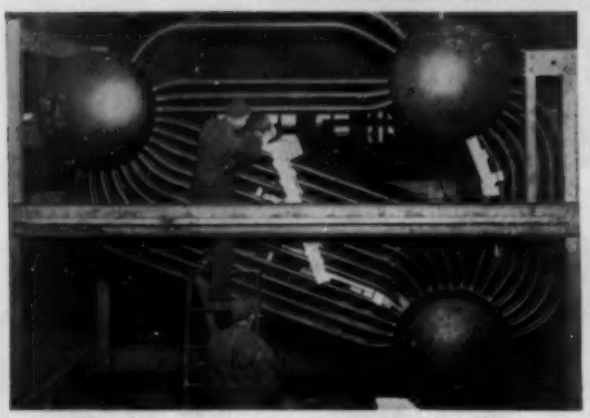
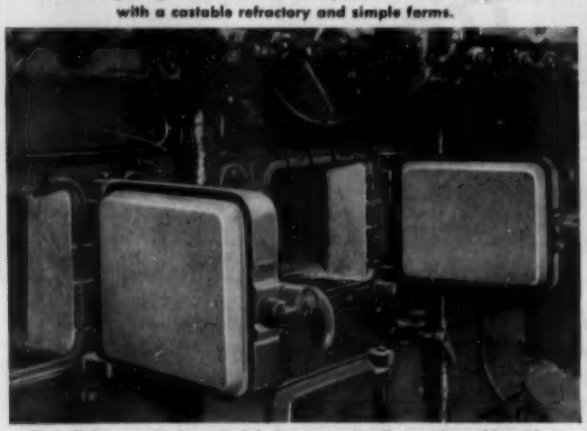
IN POWER PLANTS ON JOBS LIKE THESE:

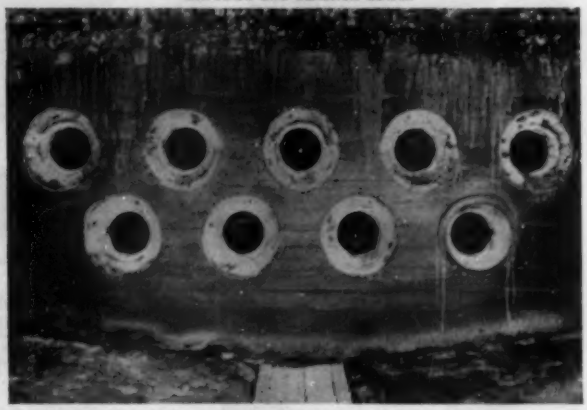


Monolithic gas-tight baffles of Refractory Concrete are easily made with a castable refractory and simple forms.

Lumnite steel stack linings keep drafts up and costly repairs due to corrosion and abrasion down.



Door linings and other special shapes are easily cast in molds with adaptable Castable Refractory Concrete.



Front wall of boiler is lined with 9 inches of Refractory Concrete—section in excellent condition after a year of service.

Castables save time and cut costs

Power-plant engineers find that castable refractories provide a fast, easy way to place or repair linings in steel stacks, breechings, boiler walls and hearths, doors, coal bunkers and ash pits. Refractory and insulating concrete made with castables can be mixed simply by adding water right on the job, and casting into place. Costs are cut and time saved because they reach service strength within 24 hours—and usually give better service than other refractories.

Castables are prepared mixes of Lumnite* calcium-aluminate cement and special aggregates selected to meet specific temperature and insulation service. They are made by manufacturers of refractories, sold through their dealers, and come ready-made for many refractory jobs.

There is no need to stock large inventories of special refractory shapes—they can be cast as needed. Keep a supply of your favorite brand of Lumnite castable on hand ready for a rush job. For more information write: Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, New York.

*"*LUMNITE*" *is the registered trade-mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

IP-L-94

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station.

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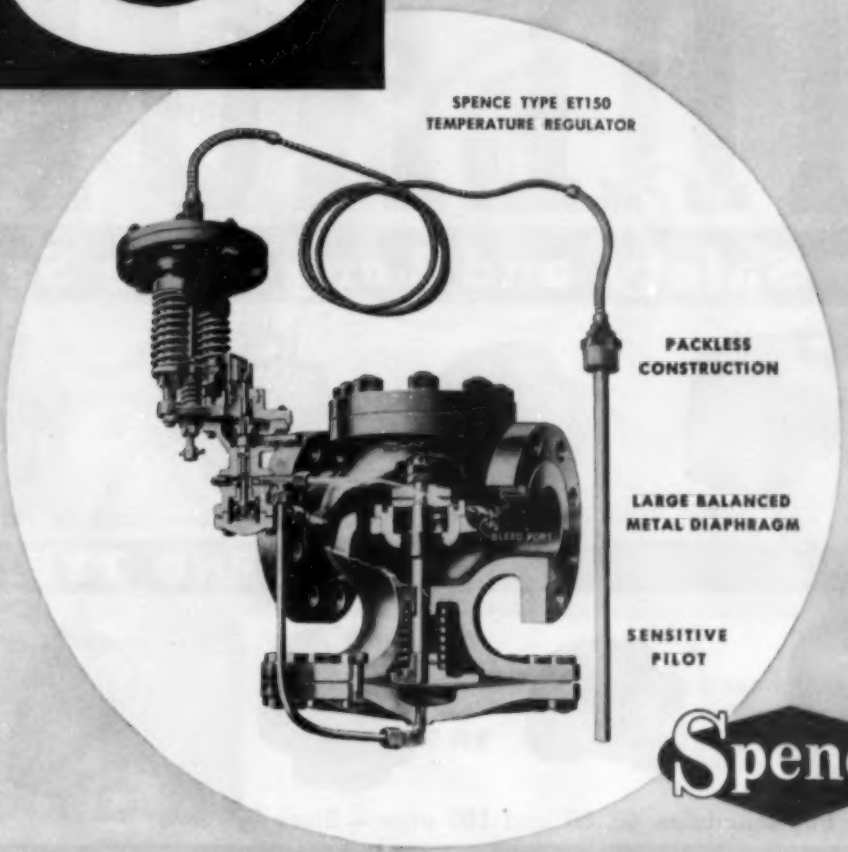
3 Reasons for Accurate Regulation



Spence

Packless construction eliminates the need for closely fitted parts that may stick or bind due to dirt or uneven expansion of the parts.

In Spence Temperature Regulators, the Main Valve is actuated by a large balanced metal diaphragm which responds to the slightest changes in temperature.

Sensitive Pilots are designed to limit heater pressure to an adjustable maximum. As the temperature at the thermostat drops a few degrees there is a corresponding increase in steam pressure up to the limit for which the Pilot is set.

With regulators that respond only to temperature, an increase in load is accompanied by a momentary decrease in steam pressure caused by faster condensation in the heating element. There is a time lag until the thermostat senses the temperature drop and opens the valve wider. Spence Temperature Regulators act like pilot operated pressure regulators when this occurs. They respond instantly to maintain the steam pressure until the thermostat has a chance to further increase it as needed for the heavier load.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

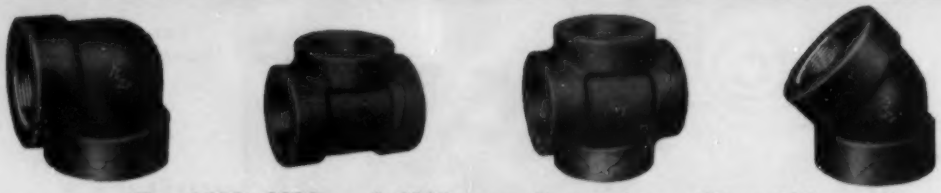
ET150

SPENCE ENGINEERING COMPANY, INC., Walden, New York

Circle 536 on Reply Card for more data

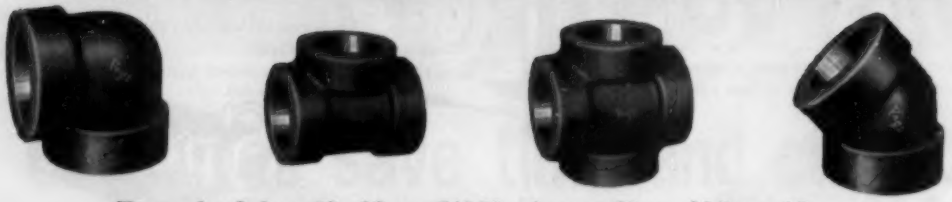
STRENGTH

for Safety and Long-Time Service



For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SCREW END TYPE



For schedules 40, 80 and 160 pipe — Sizes 1/8" to 4"

SOCKET WELD TYPE

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-9 will aid you in their selection and proper application.

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy in steam plants, petroleum refineries, chemical plants and related industries.

HENRY VOGT MACHINE CO., INC.
Louisville 10, Kentucky
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

Vogt

DROP FORGED STEEL FITTINGS

Circle 537 on Reply Card for more data

Mr. N. A. Crandall (left), Chief Power Engineer, and Standard Oil's Mr. Bill Easterwood show satisfaction with results of their teamwork.

Here's a 27,000-hour record for low wear and clean operation!

● This diesel power plant serves a large midwest manufacturer of steel products.

The plant superintendent was increasingly aware that lubrication of his two diesels was not all that it should be. There was trouble with stuck rings, and crankcases showed excessive deposits. Working with a Standard Oil lubrication specialist, the superintendent switched his engines to STANDARD HD Oil.

During some 27,000 hours' operation of each unit, engines have remained exceptionally clean. Ring sticking troubles have been eliminated. Cylinders have shown less than 0.01" wear — a reduction of 50% over the previous, similar period. Neither of the original fills of STANDARD HD have needed to be replaced.

Midwest diesel operators are getting record efficiency and economy with the help of STANDARD HD. Your Standard Oil lubrication specialist can help you get similar results. Phone your local Standard Oil office. Or, write: Standard Oil Company, 910 South Michigan Ave., Chicago 80, Ill.

STANDARD HD
TRADE MARK
OIL

STANDARD OIL COMPANY

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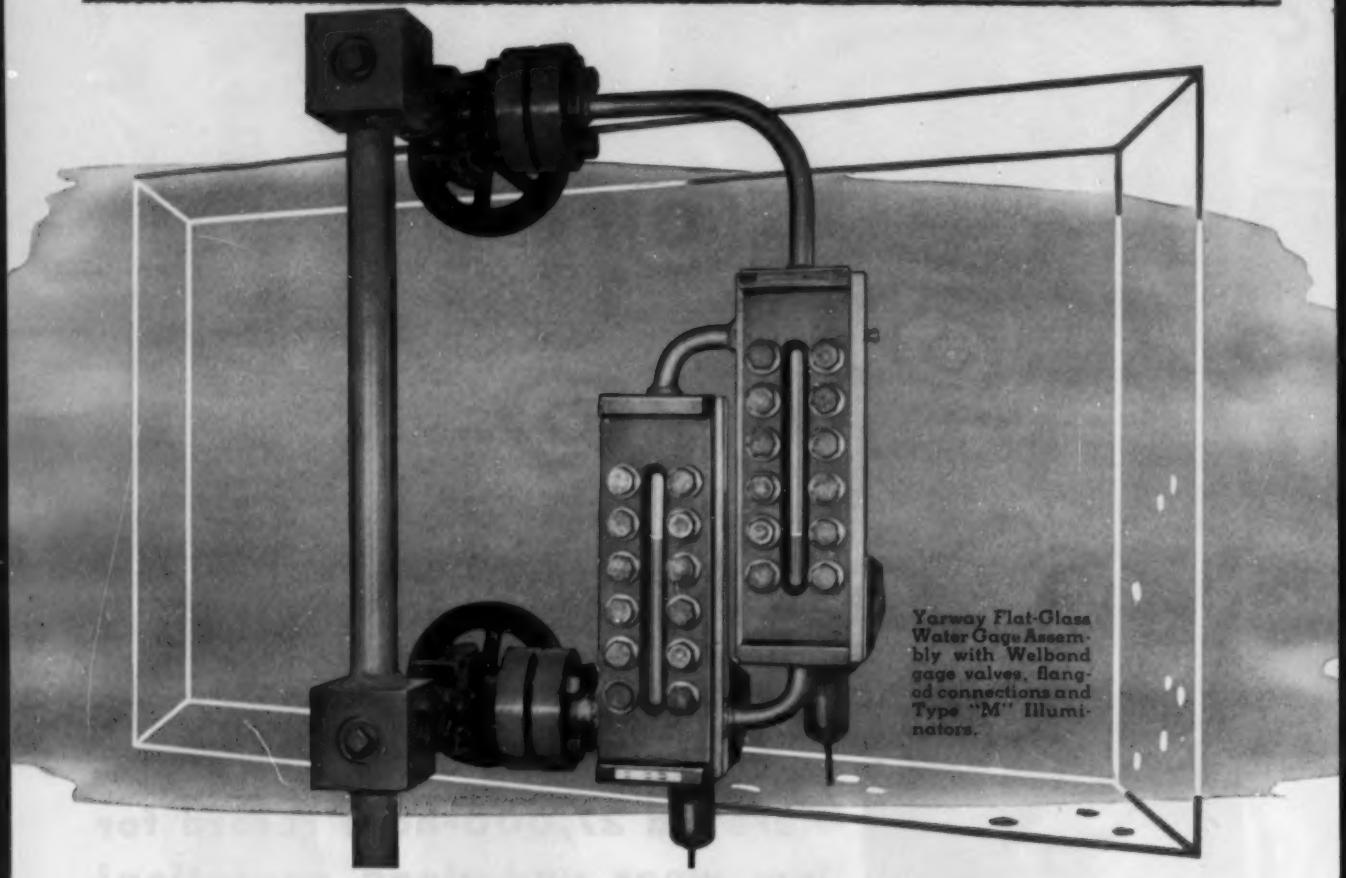
STANDARD (Indiana)

What's New

IN BOILER WATER LEVEL INDICATION?



Yarway Flat-Glass Water Gage Assembly with Welbond gage valves, flanged connections and Type "M" Illuminators.

NEW *SEPARATED-DESIGN* WATER GAGES

This new Yarway water gage assembly has been developed to meet the demands for greater dependability, longer life, and more accurate readings in high pressure service.

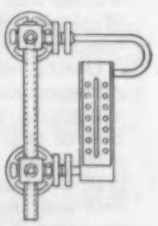
The gage glass inserts are of the Yarway pressure-sealed "floating assembly type". Yarway Welbond gage valves are used. Greater flexibility is gained by using two independent inserts, and by interconnecting expansion loops (see above).

The short connection to the drum assures greater accuracy of the gage reading, and the lower flanged connection eliminates a stuffing box. The upper flanged loop connection between the insert and gage valve allows expansion and contraction of the various components.

The tie bar-type water column linking the gage valves provides circulation to keep gage nearer drum temperature.

Yarway Type "M" Illuminators on the gage inserts cause the meniscus at water level to "shine like a star". This illuminator is especially effective in penetrating deposits on gage glass, dust particles in air and extraneous light.

For full information, write for Yarway Bulletin WG-1811.

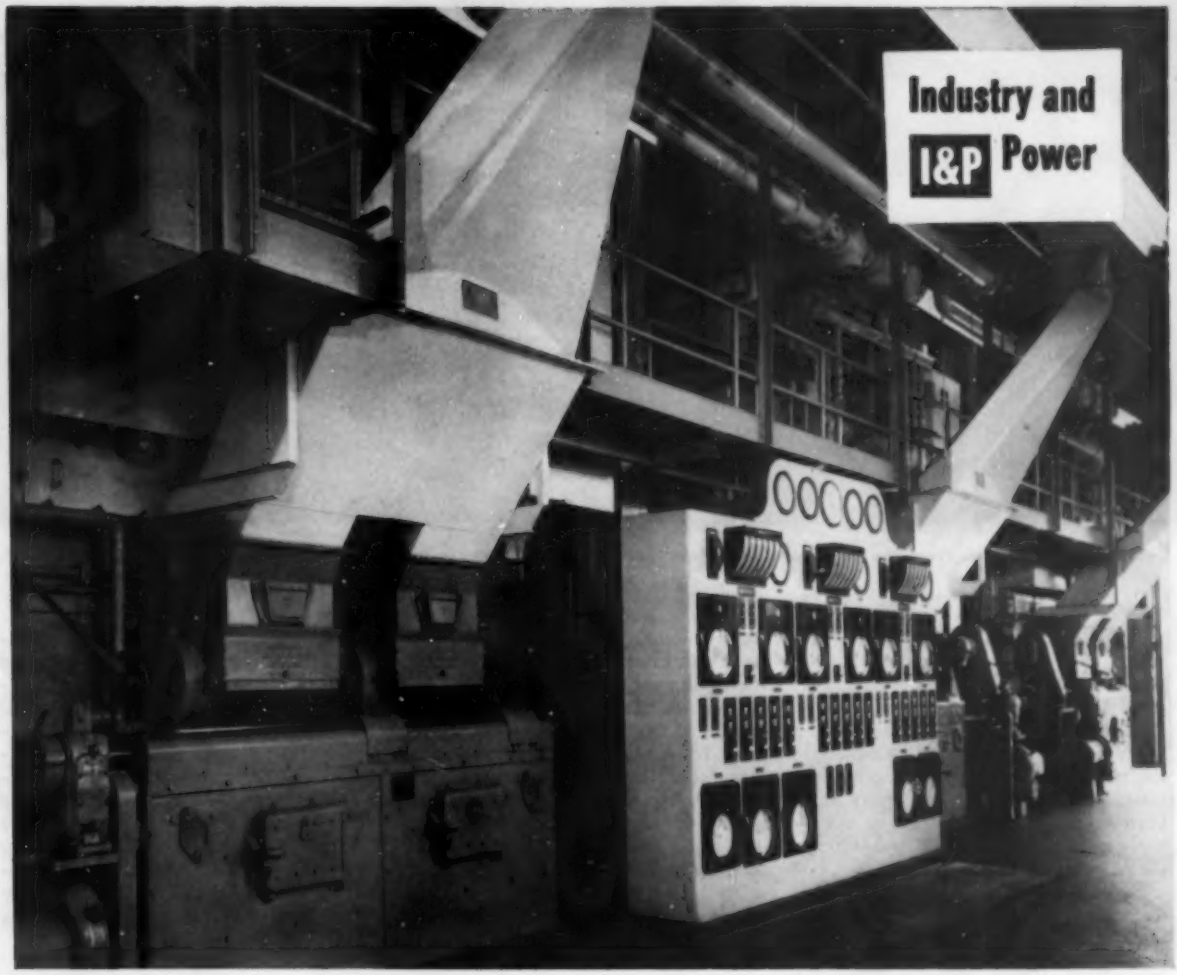


Yarway Single Insert type gage for medium range of visibilities.

YARNALL-WARING COMPANY · 109 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY STEAM PLANT EQUIPMENT

Circle 541 on Reply Card for more data



Spreader stoker firing is used for most operating conditions, but the steam generators also have auxiliary gas burners.

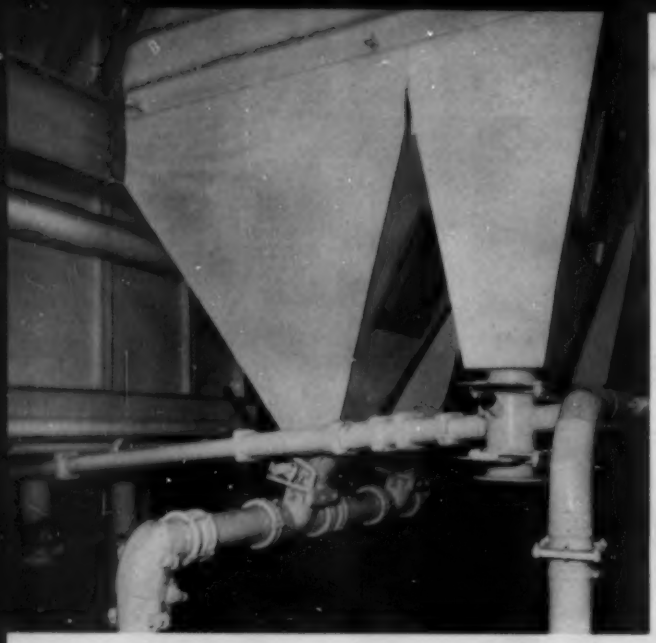
New GM Plant is Compact and Efficient

R. W. MITTE, Plant Engineer and T. K. McNEELY, Chief Engineer
Ternstedt Division, Detroit Plant
General Motors Corporation

WHEN PRODUCTION DEMANDS necessitated an increase in process steam and compressed air facilities at their Ternstedt Division Plant on West Fort Street in Detroit, General Motors Corp. was fortunate in having sufficient space available adjacent to the manufacturing area for construction of a completely new boiler house. Thus, the engineers were able to take full advantage of the multiple benefits afforded by modern equipment and thereby obtain highly efficient performance. Furthermore, it was possible to abandon the old plant area in the main building and turn the space over to production.

Design Features

Several characteristics distinguish the new plant. First, careful coordination of engineering detail resulted in an installation which has a minimum building volume without sacrificing equipment accessibility. This not only reduced the initial investment appreciably but provided ample outdoor space at the site for storing 2500 tons of coal. Second, all equipment is of dust-tight construction. The value of this design detail is apparent in the cleanliness of the cream colored interior surfaces which are a startling contrast from the dark, dingy ap-



Only coarse cinders from the collectors are reinjected.

Fines pass to the plant's automatic ash handling system.

pearance generally associated with many old time boiler rooms. Third, the same care used in the selection of the decorative scheme was extended to the choice of building materials as the engineers recognized the importance of minimizing maintenance. The quarry tile floors and glazed tile walls are easy to wash with a hose, making housekeeping simple and inexpensive.

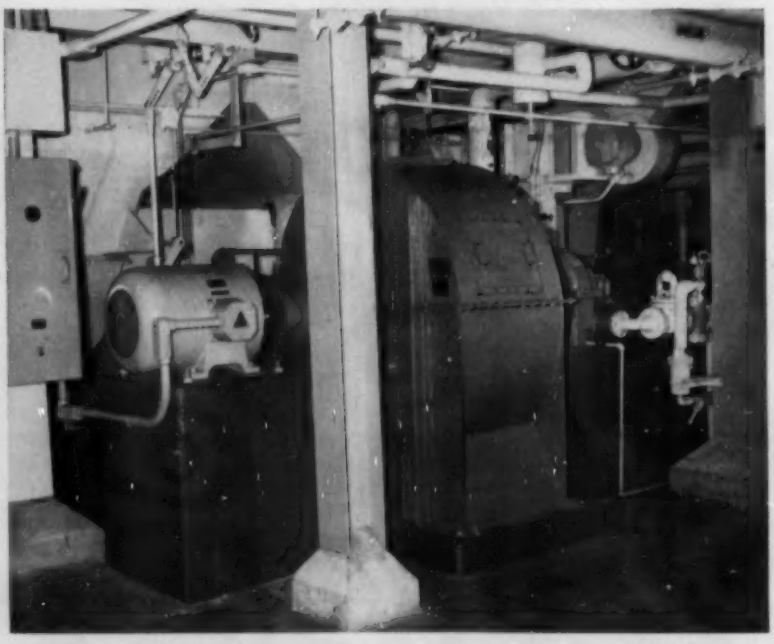
Because of the bright interior decoration and efficient lighting system, glass in the outside walls is restricted to an absolute minimum. The building itself is of steel frame construction with an exterior facing of red brick. It is mounted on a 54-in. thick floating slab of reinforced concrete, which also provides ample support for the equipment.

Type of Steam Load

Process steam requirements at this plant are relatively small. Steam is required for plating, washing, and degreasing operations to the extent of approximately 40,000 lb per hr. In the winter, heating demands raise the average total load to 90,000 lb per hr, although peaks of approximately 150,000 lb per hr have been experienced. Since power loads at the plant are high, these steam volumes did not justify in-plant generation, particularly in view of the satisfactory utility service rates available in the area.

Steam generating facilities consist of three, bent tube, two drum, boilers with fully water cooled furnaces. Each unit has a continuous duty rating of 60,000 lb of saturated steam per hr and is designed for 200-psig pressure. Normal operation is at 150 psig pressure, with one unit carrying the summer load and two units handling winter operations under most conditions. All units are arranged for dual firing using either coal or gas although utilization of gas is limited to emergencies and light week-end loads in summer. Boiler efficiency averages 82 percent for all operating conditions.

Each steam generator is equipped with a continuous discharge type spreader stoker and also four gas burners. All stokers have two motor driven feeders per boiler, and one unit also has an auxiliary turbine drive. The under-fire area is laterally zoned to insure good primary air distribution, and in addition a simple duct and damper system permits diverting of the combustion air to the gas burners when necessary. These burners are mounted in the front wall directly above the stokers where they can be served from a firing platform



FD fans in the basement supply primary air for the stokers and gas burners.

extending across all three units. This arrangement is typical of the overall plant design, which affords maximum convenience for the operators.

Normally, Ohio deep mine coal is fired at this plant even though low quality fuels can be utilized. This coal averages 13,000 Btu per lb and costs only slightly over $8.00 per ton delivered. It is delivered in railroad cars to a track siding adjacent to the plant. A car shaker facilitates the unloading procedure with the coal falling directly into a track hopper that feeds an automatic handling system containing inclined, vertical, and horizontal conveyors.

Coal Storage

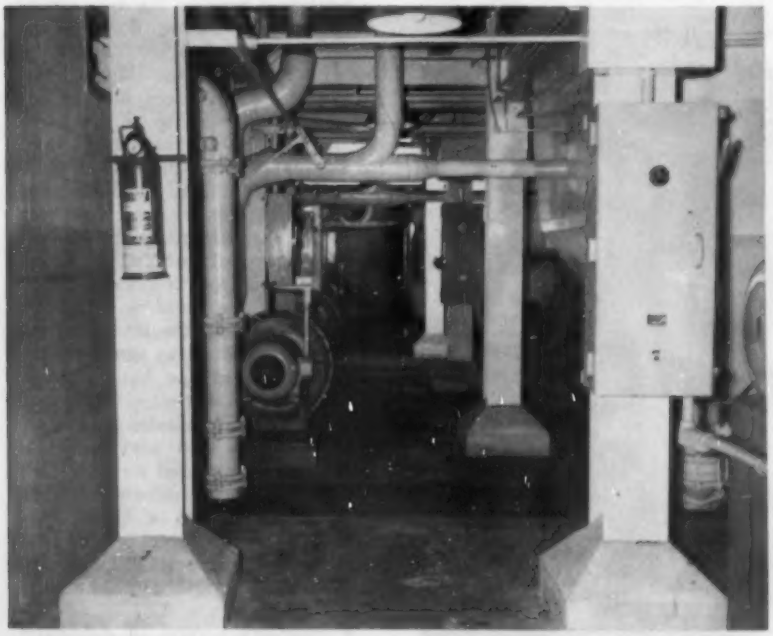
Coal can be diverted to the 2500 ton outdoor storage area or carried directly to an indoor bunker which holds 600 tons. This bunker runs the full length of the boiler room, extending well beyond the area occupied by the steam generating units, to assure maximum capacity in the available space. Its entire contents represent live storage because a drag-around conveyor is installed which can receive coal from 11 take-off points beneath the bunker and return it to individual automatic weighing scales at each boiler. The bunker is of steel construction and has a sprayed gunite lining to forestall corrosion.

Individual forced and induced draft fans were provided for each unit. The forced draft fans, located in the basement, are motor driven, and the unit for No. 1 boiler also has an auxiliary turbine drive. All induced draft fans are steam turbine driven. They are mounted on a steel frame, reinforced concrete balcony above and in back of the boilers. Selection of this location helped to hold the required height of the stub stacks to only 30 ft.

This installation also marks one of the first applications of decantation type collectors in the Metropolitan Detroit area. The decantation principle must be recognized as sound for spreader stoker firing as only the coarse carbon particles with some heating value are reinjected into the furnace. Fine soot with no heat value is dumped directly into the ash conveyor system. This arrangement prevents excessive dust loading in any of the gas passages in the system.

The necessary motor driven overfire air and cinder return fans are located in the boiler house basement adjacent to the forced draft fans. Overfire air enters the furnace through jets in both the front and rear walls, and this feature provides ample turbulence and assures active burning over the entire fuel bed. Furthermore, the fact that all mechanical draft fans are at some distance from the main firing area serves to appreciably reduce the noise level on the operating floor.

One steam driven and two motor driven compressors meet process air demands.

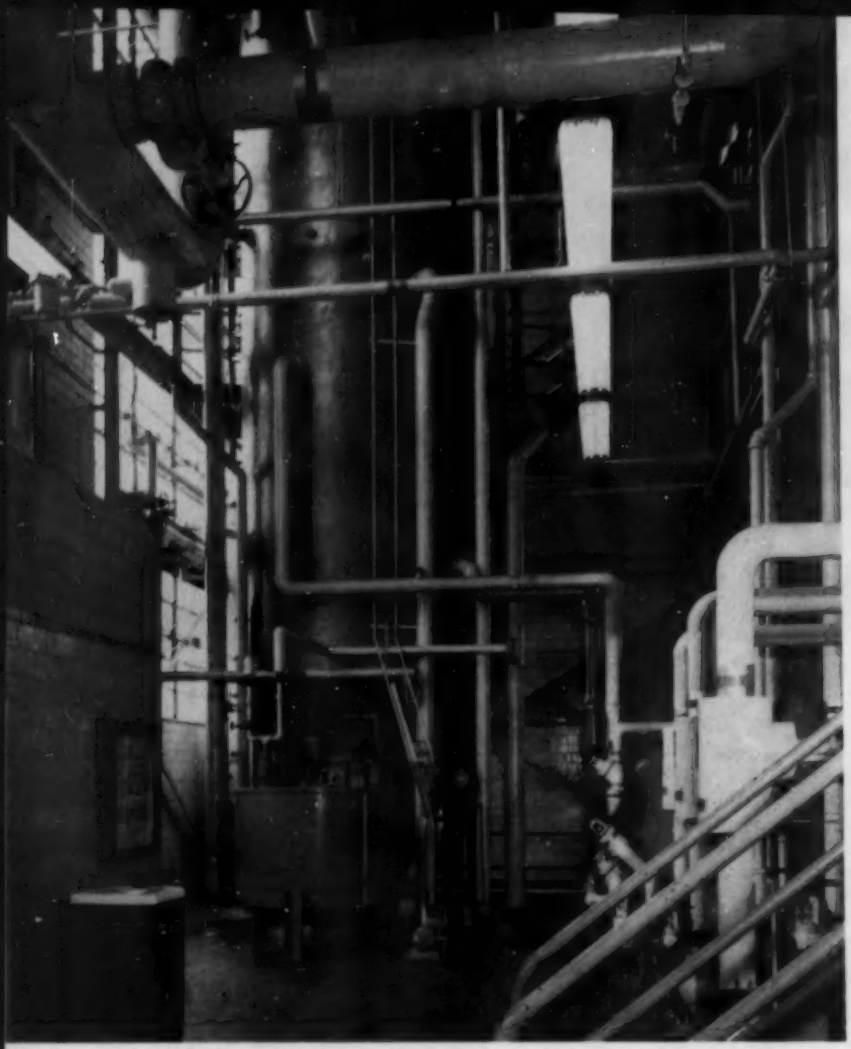


Cinder return and overfire air fans assure ample turbulence in the furnace.

Ash Disposal

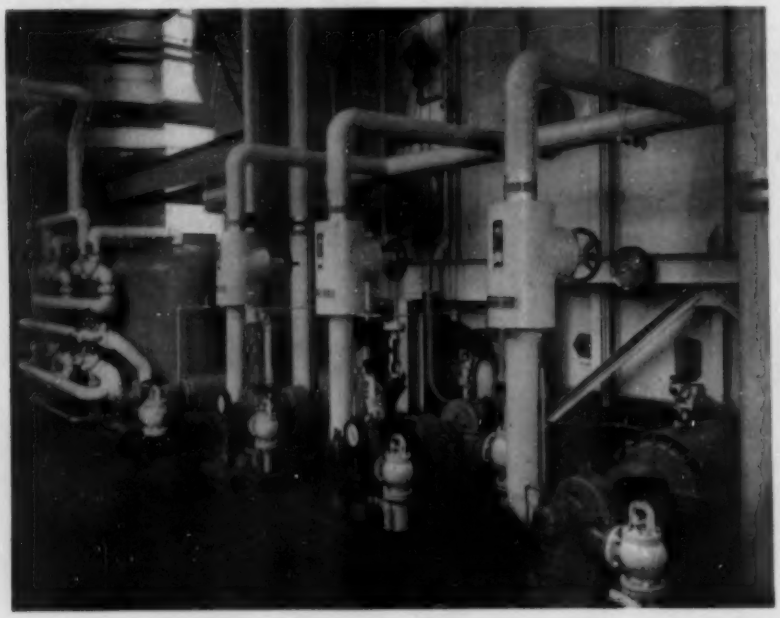
Ash discharged at the front of the furnaces and fine particles from the dust collectors pass directly to a disposal system in the basement of the boiler house. This system is of the steam actuated pneumatic type, and it transports the ash to an outdoor tile silo. Any dust from the plant's vacuum cleaning system also is removed in this fashion. The ashes are picked up by trucks, which receive the refuse through a dustless unloader with water sprays.

Feedwater problems at the plant are somewhat complicated by the fact that condensate returns are limited. These returns accumulate in a receiver in the manufacturing



Feedwater is pretreated and deaerated in a hot process lime-soda softener.

Well arranged, clearly identified feed lines typify the entire plant design.



area where the water is picked up by transfer pumps and carried to a flash tank in the boiler house. In summer, makeup (which comes from the Detroit water supply system) averages 95 percent of the total feed. Condensate from the heating system is returned in winter, reducing the average makeup to approximately 50 percent although the actual raw water quantity remains nearly constant throughout the year.

Makeup water is pretreated in a hot process lime-soda softener. This unit includes separate deaerating sections for both condensate and makeup, and has an integral storage compartment. Exhaust steam from the boiler room auxiliaries and a controlled volume of live steam are employed to maintain an operating feedwater temperature of 238 F. Effluent from the softener passes through two pressure type filters, and then receives secondary phosphate treatment before entering the boiler feed pumps.

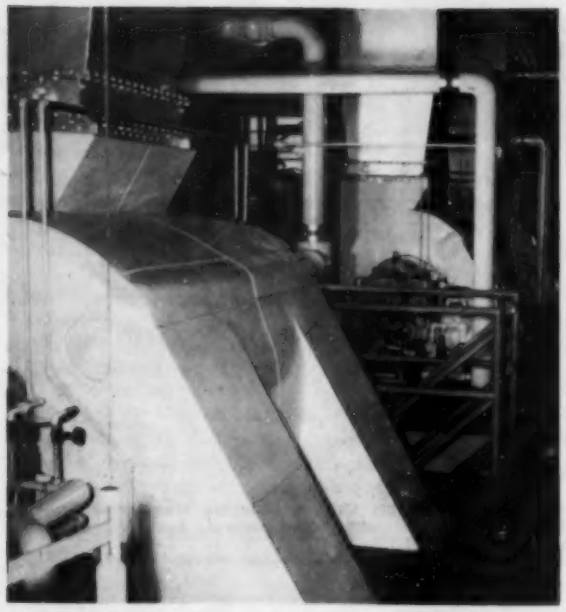
Three, centrifugal, 200-gpm boiler feed pumps are installed on the operating floor in proximity to the softener and filters where they can be readily observed by the operators. Two of these pumps are turbine driven while the third is equipped with an electric motor. Two pumps operating at any one time would supply more than adequate capacity even if the load demand required the operation of all three boilers at full capacity.

Arrangement of Piping

The installation of these pumps is outstanding because the only piping above the operating floor is the pump discharge headers. High pressure steam, exhaust steam, and pump suction headers all are installed on the ceiling of the basement with only short connections to the pumps through the floor. This arrangement not only isolates considerable equipment from the firing area but also eliminates the attendant necessity of running long rod hangers or supporting steel to the high roof of the building.

Similar care in the layout of the equipment extends to the principal service lines in the boiler house. All pipes have colored identification bands and decalcomanias to indicate flow direction and service. Main steam and compressed air lines pass overhead to the manufacturing area, being supported on a 600-ft long outdoor, structural steel trestle. This framework also carries the return lines from the receiver in the manufacturing area.

A complete system of automatic combustion controls was provided



Turbine driven ID fans maintain constant furnace draft.

Automatic scales continuously record fuel consumption.

with the steam generating units. These controls maintain constant steam pressure by adjusting fuel feed and primary air flow rates in accordance with the load demand. Separate control of the induced draft fan speed assures the maintenance of a constant negative furnace pressure. Operating conveniences include eye level water gages, and smoke indicators, as well as other necessary instrumentation.

Compressed Air

The boiler plant also satisfies the plant's process air requirements. There are two motor driven, reciprocating, opposed type, horizontal compressors and one steam driven compressor mounted on the operating floor. The motor driven units have a capacity of 4100 cfm each while the steam unit supplies 4000 cfm. Two units are required to supply a 7000-cfm process demand although use of the steam driven compressor normally is confined to winter operation.

One feature of the compressed air system is the additional economy achieved through a cooling water reclaiming arrangement. Cooling water is returned to a 1000-gallon tank, and then part of it is recirculated to the water softeners. The balance is used for duties around the boiler house such as supplying the water sprays on the dustless unloader which serves the ash silo.

Operation of the plant started in January 1953, and consequently performance has been observed for slightly over one year. Service is extremely satisfactory in all respects, and outstanding economy is being achieved. The facilities also will be able to handle higher loads if production demands increase.

PRINCIPAL EQUIPMENT

Steam generators	The Babcock & Wilcox Co.
Dust collectors	Prat-Daniel Corp.
Overfire air and cinder return system	Detroit Stoker Co.
Soot blowers	Diamond Power Specialty Corp.
Spreader stokers	Detroit Stoker Co.
Feeder drives	Reeves Pulley Co.
Grate drives	Link-Belt Co.
Auxiliary turbine	Elliott Co.
Forced draft fans	Clarage Fan Co.
Forced draft fan turbines	Terry Steam Turbine Co.
Induced draft fans	Green Fuel Economizer Co., Inc.
Induced draft fan turbines	Elliott Co.
Overfire air fans	Clarage Fan Co.
Cinder return fans	Buffalo Forge Co.
Combustion control	Republic Flow Meters Co.
Smoke indicators	Bailey Meter Co.
Coal handling system	The Fairfield Engineering Co.
Coal car shaker	National Conveyors Co., Inc.
Automatic coal scales	Richardson Scale Co.
Ash handling system	United Conveyor Corp.
Boiler feed pumps	Worthington Corp.
Feedwater regulators	Copes-Vulcan Division
Water columns	Reliance Gauge Column Co.
Eye level water gages	Yarnall-Waring Co.
Hot process softener	Graver Water Conditioning Co.
Filters	Graver Water Conditioning Co.
Chemical feed pumps	The Wainman Pump Mfg. Co.
Backwash pumps	The Wainman Pump Mfg. Co.
Nonreturn valves	Golden-Anderson Valve Specialty Co.
Safety valves	Manning, Maxwell & Moore, Inc.
Service line valves	Crane Co.
Steam traps	Armstrong Machine Works
Motor driven compressors	Clark Bros. Co., Inc.
Steam driven compressor	Ingersoll-Rand Co.
Compressed air flow meter	Bailey Meter Co.
Boiler instrumentation	Republic Flow Meters Co.
Switchgear	Clark Controller Co.
Motors	Delco Products Division
Water consultant	Hall Laboratories, Inc.
Engineering	General Motors Corp.

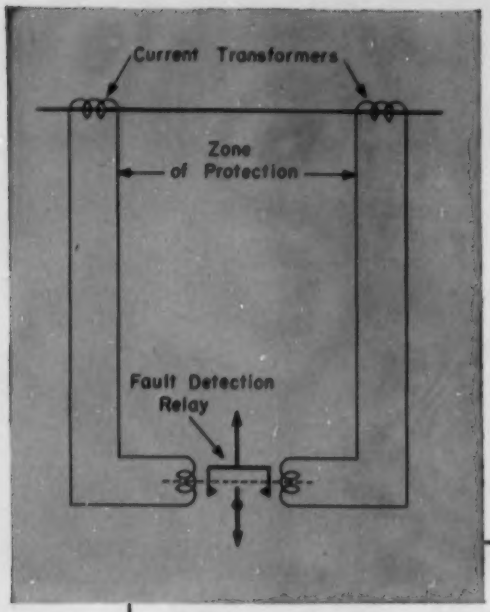
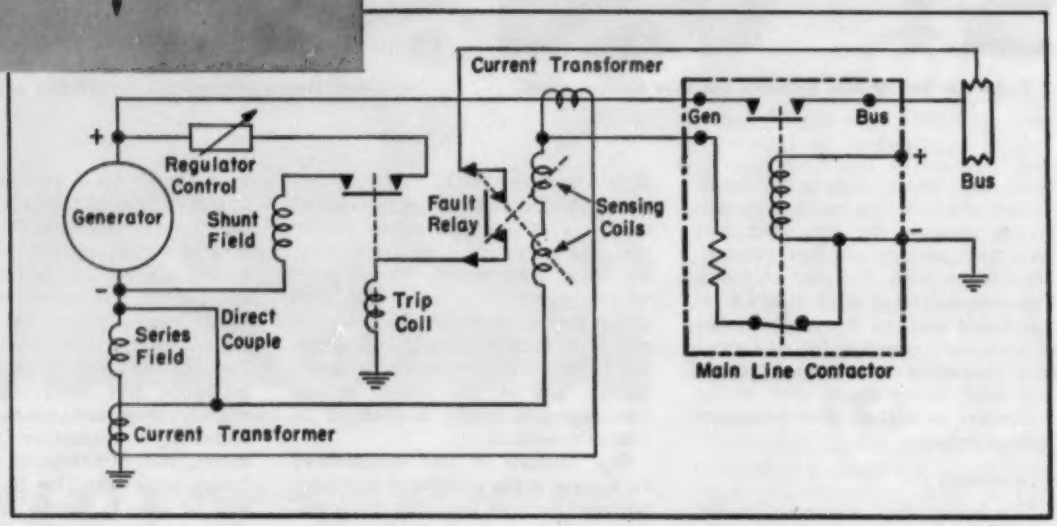


Fig. 1 — When a fault occurs in zone of protection (left) differential currents flow and trip the fault relay.

A new transformer makes possible fault protection on d-c industrial distribution systems with no power consumption except during a fault. Method depends on differing rates of current change in the system.

Fig. 2 — Unequal currents between bucking transformer coils trip relay on fault; normally, equal currents buck and cancel.



Jack & Heintz

Detecting D-C Systems Faults

A NEW FAULT detection method can be incorporated into industrial d-c power circuits. One of the unusual design aspects of the new circuit is the fact that current transformers are used. General belief has held that transformers in d-c control circuits are impractical. Actually, the transformer used in this circuit is of special design, using a very large air gap (0.075 inches).

The air gap in the transformer's magnetic path makes possible a large turns ratio for indirect coupling of the protected and the sensing circuits. This large turns ratio gives a very high degree of sensitivity to rates of change in current. Whereas conventional transformers reach saturation rather early and would be impractical for this type of control application, the special transformer exhibits linear response throughout the load range.

There has been continued interest in the indirect-couple technique because it offers several advantages in comparison to shunt-type circuits in general use.

Power demand is reduced. Shunts require power — which means a steady state power loss in the system. Indirectly coupled transformers do not need power.

Voltage drop is reduced. Shunts must be connected directly in series with the feeder cables, resulting in a voltage drop across the shunt. Indirect coupling creates no such voltage drop.

Sensing lead resistance is not critical. With the shunt-type circuit the resistance between the shunt and the sensing relay coil is critical. Changes in temperature can cause circuit unbalance and can result in nuisance trips under regular load. The indirect couple is not subject to such trouble.

Maintenance is easier. Shunts require joints to be made in feeder cables for connection into the circuit. Because at least two shunts are required in each circuit, a mini-

mum of four joints must be made. Aside from the actual work involved, each joint is a possible fault area. The indirect couple requires no joints.

Size and weight of components is reduced. This transformer is smaller than the comparable shunt.

The indirect-couple circuit involves two current transformers located electrically to offer a maximum zone of fault protection to feeder cables and generator. Each of the current transformer secondaries is connected into either single or dual comparison circuits which include a fault detection relay. Basically, therefore, the detection of a ground fault in the protection zone between the transformers depends upon a differential in the rate of current change in the current transformer primaries (Fig. 1).

Direct Couple

To insure that faults present during generator build-up are detected, a direct coupling is made from the negative brush of the generator to one side of the fault detection circuit and from the other side to the ground. This circuit will detect any voltage build-up on the generator interpole and compensating windings and will signal the fault relay to close its contacts. A set of normally closed contacts open and close the directly coupled circuit as required. During generator build-up when the electrical system is disconnected from a bus by a main line contactor, the directly coupled circuit is completed by an auxiliary set of main line contactor contacts, and, it is this circuit which detects any faults. When the main contactor is closed, the directly coupled circuit is open and the indirectly coupled circuit will detect the ground faults.

The fault detection circuit requires the use of a non-polarized relay. Certain ground faults cause the fault current to build up in a positive direction again. This kind of fault may result from an intermittent contact of a cable with a grounded section. The non-polarized relay is necessary to properly detect this fault. In comparison, it may be stated that the polarized type fault detection relay will sense the change in direction of the fault current and will chatter during this type fault.

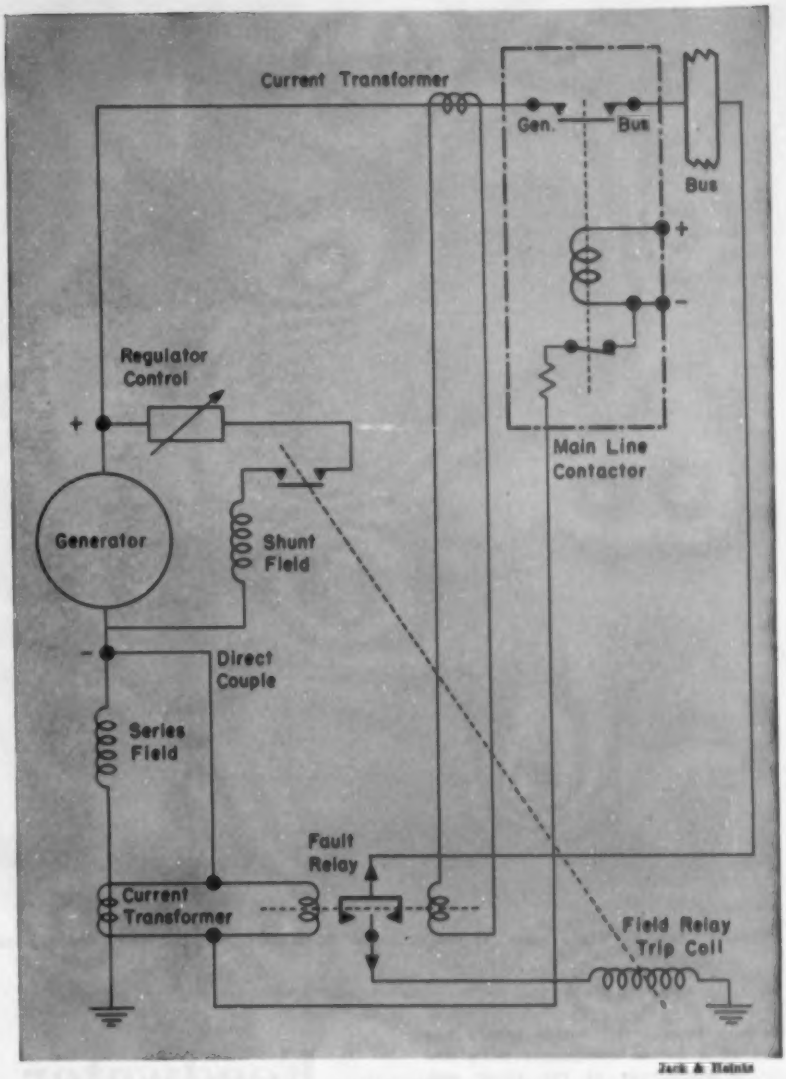
The method of fault detection described can take two circuit forms:

In a single series loop circuit (Fig. 2), two current transformer secondaries and both relay coils are in one series loop. The current transformers are connected to oppose each other during load application and removal. Because equal opposing signals are imposed on the two relay coils, and this results in zero magnetic force on the relay armature. The directly coupled circuit from the generator terminal to the ground through the main contactor signals one coil when a fault is present during generator build-up.

This circuit will result in a system trip when a protected cable opens or shorts. This circuit is recommended for industrial circuits where the removal of one generator will not create an emergency.

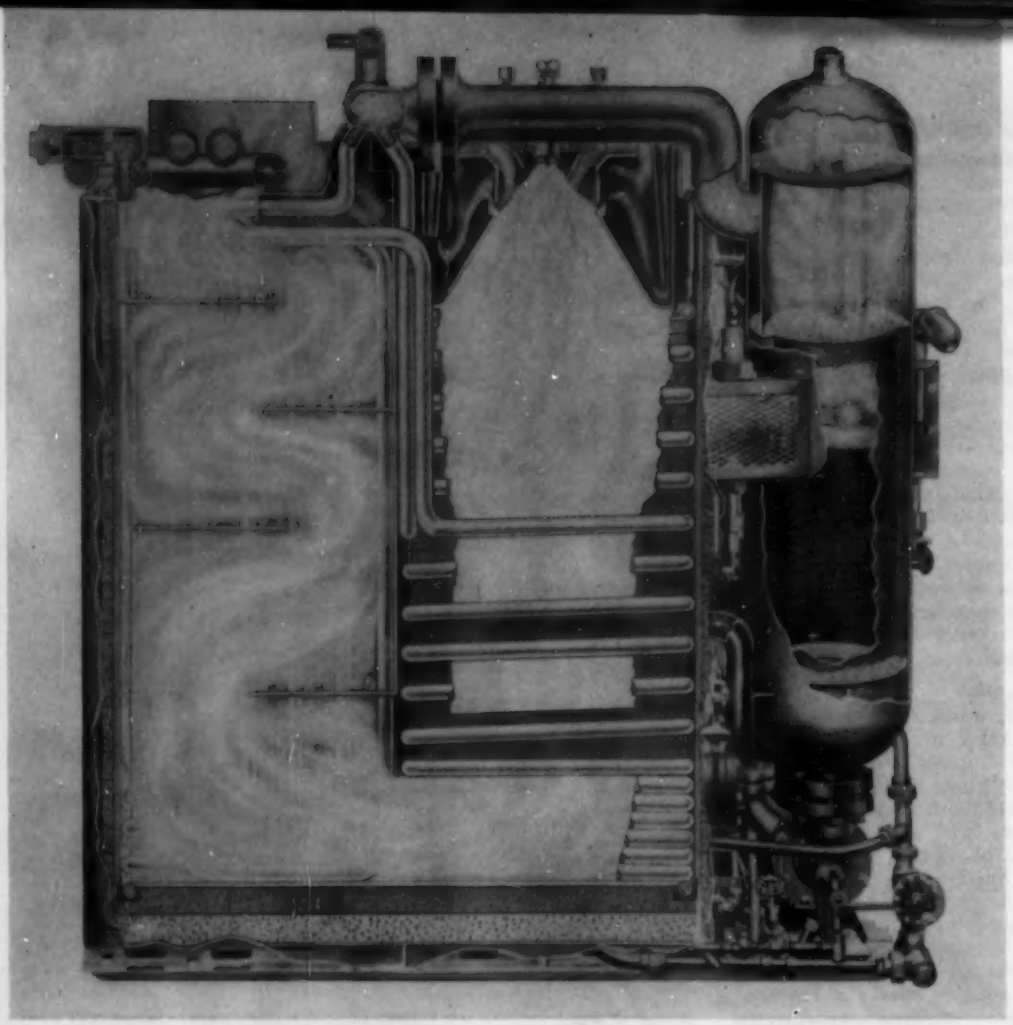
In the other form, the transformers are connected in two separate series loops and the relay coils are connected opposing (Fig 3). With the application of loads and other switching transients, equal signals are present, there is no current flow in the series loop. When a ground fault occurs, a signal is impressed on only one of the current transformer secondaries. This causes a current flow in the series loop which energizes the two relay coils connected series adding. The directly coupled circuit from the generator terminal to ground through the main contactor signals the two relay coils in series when a fault is present during generator build-up.

This single series loop circuit will not result in a system trip when protected cables open or short. The circuit is recommended for use on single and perhaps dual generator systems where the removal of a generating unit may cause an emergency condition.



Jack & Heintz

Fig. 3 — This system uses two series loops with opposing relay coils. The relay will trip if the sensing leads develop an open or a short circuit.



Low hardness water is desirable for controlled recirculation units to permit reasonable blowdown rates.

In flash type units, water enters one end of a set of continuous coils and steam discharges at the other end. Treatment must be used continuously.

Feedwater Treatment For Package Boilers

M. F. NIELSEN, Supervisor
Technical Service Department
National Aluminate Corporation

MODERN SELF-CONTAINED steam generators, commonly referred to as package boilers, often differ radically from conventional designs. A number of basic arrangements are used, varying from the flash unit to those that appear to be modifications of the well recognized types of boilers. These design variations necessitate a new approach in the science of boiler feedwater conditioning.

Package steam generators usually are fabricated in the manufacturers' plant and shipped as complete units including all controls and safety devices. Installation time is minimized because only the connection of fuel and service lines and stack outlets is required after a unit is set in

place. Ease of installation plus the advantages of availability, highly automatic operation, and small space requirements relative to steam output have made package boilers increasingly popular for commercial establishments, institutions, and industrials with moderate steam loads.

Analogous Characteristics

Possibly the greatest similarity among the various package boiler types is the ability of these units, with small physical dimensions, to produce large amounts of steam. To accomplish this result, most designs use relatively high heat transfer rates and incorporate a high proportion of steam generating area per unit of boiler volume. Therefore, the water side of heat transfer surfaces must be kept absolutely clean to maintain design performance without serious difficulties.

Another characteristic common to all package boilers is the small water holding capacity in relation to the steam output. The volume of water in the boiler may be only a small fraction of the quantity evaporated during each hour of operation. This differs greatly from large conventional boilers where the water volume usually is sufficiently great to permit slug feeding of chemicals at intervals of an hour or more. With such units, the water in the boiler acts as a reservoir of treatment which is ample to condition incoming feedwater properly between chemical additions. However, in package units chemicals must be added continuously and in the correct proportion so that essentially every drop of feedwater receives uniform treatment. Serious deposits can result from alternate overtreatment and undertreatment.

Flash Type Generators

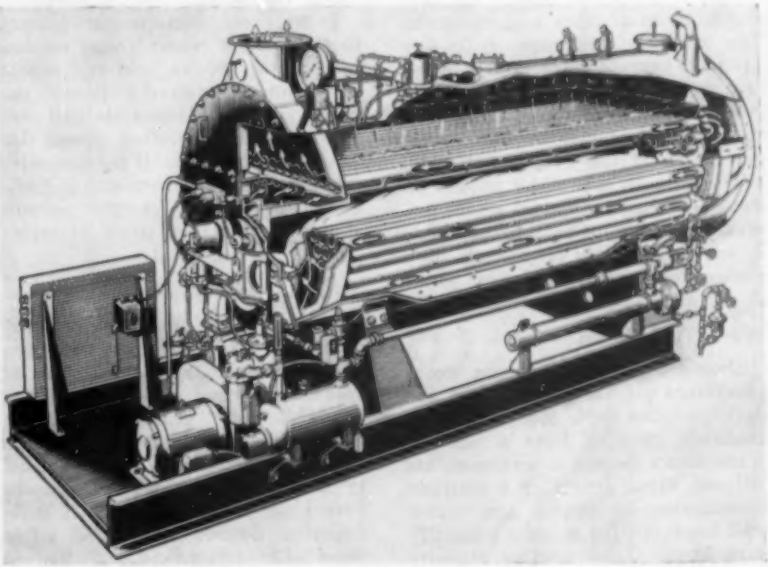
Flash type steam generators usually are composed of a continuous set of coils arranged so that cold water enters one end and steam discharges to the steam separator at the other end. Total water pumped into the inlet of the coil is from 105 to 110 percent of the output, the excess water serving to carry soluble salts and precipitated sludge out of the coils. This water is removed from the steam in the steam separator and discharged by blowdown or returned through a heat exchanger to the feedwater tank.

Feedwater for flash type units should be of very good quality (although not necessarily equivalent to distilled water) so that concentration of the boiler water dissolved solids will be held as low as possible. The hardness should be low to reduce the sludge content to a minimum and to increase the time intervals between washouts. Chemical treatment must be correct and applied continuously to every gallon of feedwater.

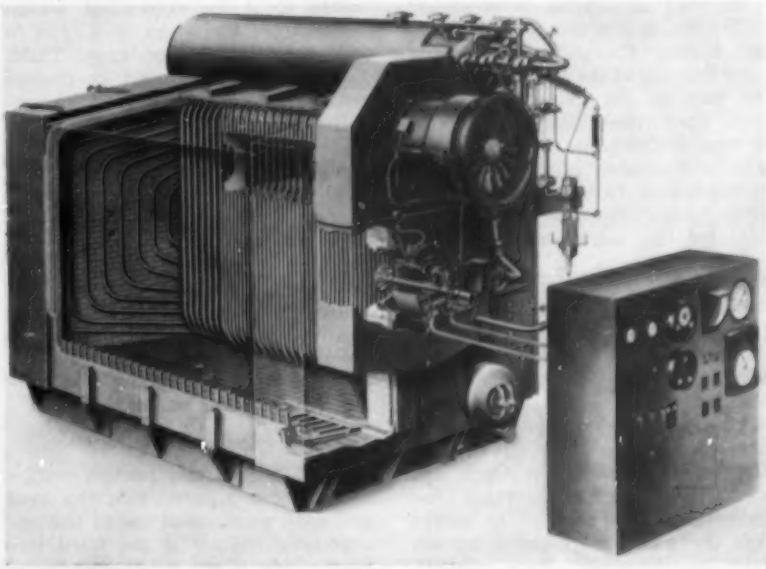
Firetube Boilers

Modified Scotch type boilers, with various arrangements of controls and gas passages to obtain high efficiency, are made by a number of manufacturers. In general, these multiple pass, firetube generators have higher water holding capacity than some other types of package units. Good quality feedwater is very desirable to prevent excessive sludge build-up at normal concentrations.

Treatment chemicals must maintain near zero hardness in the boiler water and provide sludge that is free-flowing and removable by normal blowdown. Chemical feed should be continuous enough to avoid wide fluctuations in boiler water treatment level. Since this type of unit is difficult to clean mechanically the



Treatment for firetube boilers must maintain near zero hardness in the water.



Water tube designs require good quality feedwater to minimize sludge content.

emphasis should be on proper conditioning to keep water side surfaces clean.

Controlled Recirculation Units

In the controlled recirculation type of steam generator, the volume of water which is circulated through the unit at all times is as much as 10 times the steaming capacity. Flow is proportioned to the steam generating tubes to provide a high water velocity. Steam is taken off at the steam separator, and the balance of the water recirculates through the tubes.

Feedwater problems with controlled recirculation boilers are similar to those of other package units. The water holding capacity is low (10 to 15 percent of the hourly evaporation under full load) which necessitates the continuous addition of treatment chemicals in the correct proportion to the evaporation rate. Low hardness raw water should be used (externally softened where necessary) to permit reasonable blowdown rates without excessively high sludge content in the boiler water at normal solids concentration.

Water Tube Boilers

Shop assembled, water tube steam generators also are common in the package boiler field. Many types are available, ranging from a number of two drum designs to arrangements utilizing three drums or a multiple combination of drums and water wall headers. These units generally have larger water holding capacity than flash or controlled recirculation boilers. However, they do have a high evaporation rate for the volume of water in the unit.

Thermal circulation is employed in the multiple drum type of package boiler. Circulation is usually good because of the high heat transfer rate in the generating tubes. Here again, good quality feedwater is very desirable in order to minimize the quantity of sludge formed in the boiler. Continuous, correctly proportioned chemical treatment is necessary for satisfactory results.

Water Conditioning Programs

With all types of package steam generators the proper handling of water problems is particularly important because of the high heat transfer rates employed and the large area of steam generating surface confined in a small volume. When a package boiler is purchased, a four point water conditioning program should be adopted to assure that the treatment satisfies certain basic requirements. Each part of the program is equal in importance and depends upon the others for complete success.

Establishing Requirements

Point 1. At the time of purchase of a modern small steam generator, a reliable boiler water treatment specialist should be consulted to obtain complete information concerning plant requirements. This will include: surveys of the water and steam systems, analyses of all available raw waters to determine the best possible source of makeup, and evaluation of the quality and quantity of condensate returns to establish the probable composition of the boiler feedwater.

From these data, the consultant can prepare a report giving recommendations on the type and extent of treatment required to protect the entire system against scale and corrosion while providing clean dry steam for plant use. If the necessity for external pretreatment is indicated, equipment for this service should be installed prior to initial operation of the boiler.

Selecting the Treatment

Point 2. After the plant requirements are established, the next step in the program is the selection of correct chemical treatment to accomplish four primary purposes. First, sufficient alkali or phosphate softening compounds must be used to maintain boiler water hardness very close to zero to prevent scale deposits. Second, suspended solids must be kept in a fluid, nonadherent condition so that they will circulate freely with the boiler water and be removed by normal blowdown procedure. The quantity of suspended solids must be controlled within reasonable limits to prevent a baked-on sludge condition. Third, the boiler water should be treated to make it noncorrosive to the metallic surfaces. Fourth, provisions should be made to assure smooth boiling without foaming so that good quality steam will be produced. Modern antifoam materials will prevent foaming and minimize other forms of carryover. Often, the boiler feedwater treatment materials required to produce desired results are applied in briquette form to simplify feeding and eliminate the need for precise weighing of chemicals by operating personnel.

Installing Feeding Equipment

Point 3. Selecting feeding equipment which will provide the best and most economical use of the necessary chemicals is the third important part of any conditioning program. The chemical consultant should recommend feeders or solution tanks and pumps which are properly sized to give convenient and continuous proportioning of chemicals to the boiler feedwater at all times that the steam generator is operating. Chemicals can be only as effective as the proportioning or feeding equipment.

Service

Point 4. The final consideration in a water treatment program is service. Control of boiler water quality is equal in importance to a complete knowledge of plant conditions, the treatment procedure, and the method of chemical application. A trained water treatment chemist or engineer should instruct the plant operators in the simple control tests and adjustments of chemical feed and blowdown systems which are necessary for successful continuous operation of the steam generator. Frequent, regular, personal service calls, including analyses of pertinent water samples, are required to maintain the desired quality control and to correct any potentially troublesome conditions that may develop. Occasional laboratory analyses of water samples also should be an integral part of the program.

While most plants operating package units have moderate steam loads and usually chemical consumption is not large, reliable water treatment is still essential. Chemical consultants will supply field service and laboratory analyses at a moderate cost, thereby enabling these plants to obtain the same high quality control that is available to large utility and industrial boiler plants.

Summary

High efficiency in any size boiler can be maintained only by keeping all heat transfer surfaces absolutely clean. On the water side this means the prevention of scale and sludge deposits that can rapidly form insulating layers and reduce the steaming capacity of the boiler. In package units a relatively thin deposit of scale can, with the high heat transfer rates usually employed, cause serious overheating or complete failure of the boiler metal.

Feedwater treatment for small modern steam generators should be considered equal in importance to that required for large boiler installations. All of the factors for coordinated treatment can be obtained through a service agreement program, available from the leaders in the water industry. Such programs are tailor-made for each plant and provide assurance of continuous, efficient, and trouble-free operation.

Estimating Heating Value of Coal

THOMAS H. DUFFY
Fuel Service Engineer
Chesapeake and Ohio Railroad Co.

THIS NOMOGRAPH presents a simple means of checking coal analyses to show the Btu/lb as related to the other proximate values. It is based on data which appears in Kent's M.E. Handbook, "Power", 11th Edition, pages 4-20, Table 6, "Empirical Relations for Coals of the United States", and applies to the coals of Pa., Ohio, W. Va., Md., Va., Ky., Ga., Tenn., Ala., Ind., Ia., Neb., Kan., Mo., Okla., Ark., and Texas.

Given the following proximate analyses:

	(As Received)
Moisture	4.54 Percent
Volatile	24.56 Percent
Fixed Carbon	66.70 Percent
Ash	4.20 Percent
	100.00 Percent

The heating value can be checked by:

1. Moisture + Ash = 4.54 + 4.20 = 8.74.
2. Enter Volatile Scale at (a) with 24.56 percent.
3. Pass straight-edge from (a) to (b) at 8.74 percent.
4. Extend to point (c) and Btu = 14,230.
5. This checks the actual heating value of 14,303 BTU within .5 of one percent.

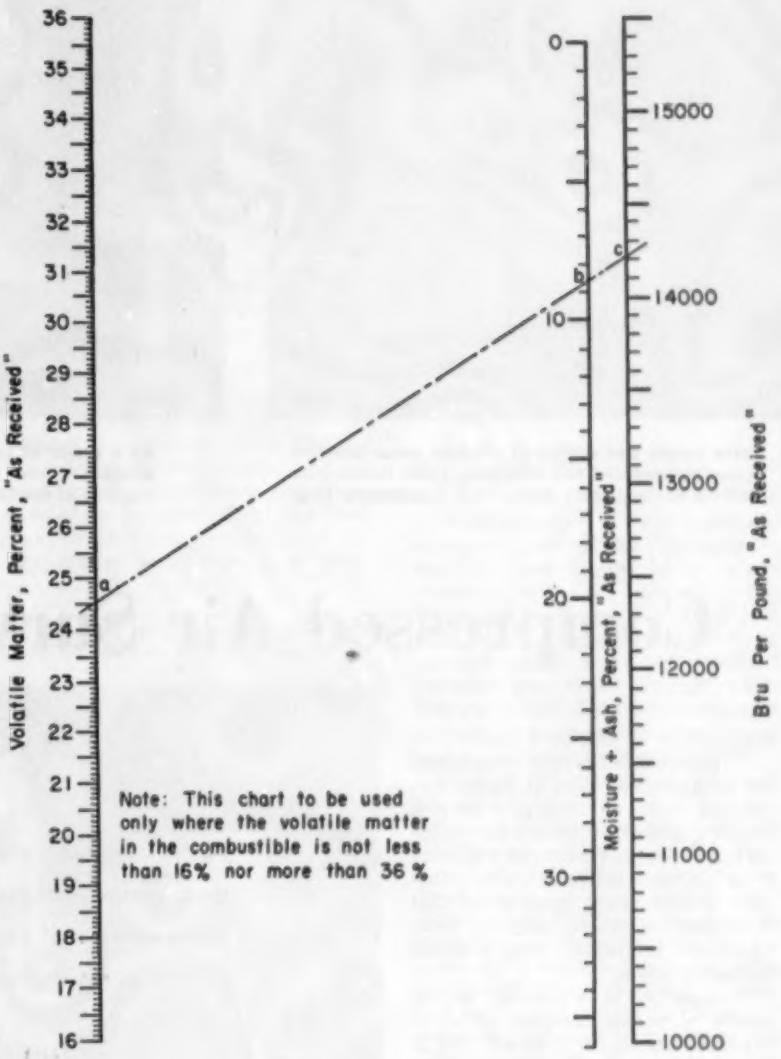
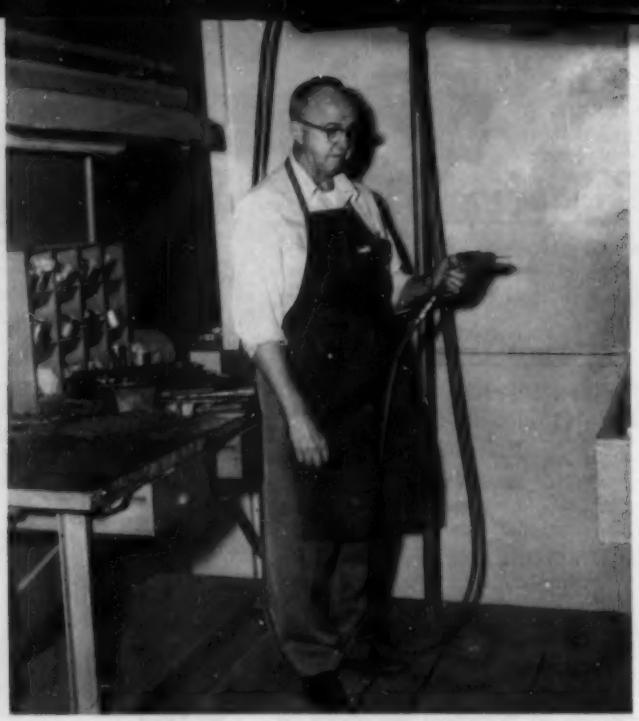


TABLE INDICATING RELATIVE ACCURACY OF METHOD

No.	Moisture	Volatile	Fixed carbon	Ash	Sulphur	Btu	Btu chart
1	6.04	24.73	65.94	3.29	.91	14207	14120
2	8.31	18.20	68.39	5.10	.69	13689	13620
3	6.96	18.57	68.64	5.83	.76	13775	13680
4	2.67	17.68	75.41	6.24	.48	14335	14350
5	4.16	16.24	74.32	5.28	.62	14287	14280
6	4.54	21.03	68.44	5.99	.63	14114	14030
7	2.56	21.35	70.92	5.17	.57	14537	14450
8	3.63	32.91	58.87	4.59	.83	14065	14100
9	2.80	32.90	59.40	4.90	.75	14250	14200
10	4.35	25.67	76.50	4.92	.64	14164	14100
11	3.79	26.37	64.13	5.71	.63	13978	14150
12	4.40	22.07	67.85	5.67	1.15	14094	14080
13	3.65	25.12	67.61	3.62	.62	14492	14450

Extra length and coiling of air hose mean pressure losses and reduced tool efficiency. Hose (taken from bottom of feed line) becomes a condensate trap.



As a result of survey, length of hose was reduced, eliminating need for coiling. Hose is now taken from top side of the feed line so it does not collect water.

Compressed Air Survey Brings Major Savings

A thorough survey showed Ryan engineers that casual attention to compressed air facilities is not enough. An adoption of survey recommendations is paying off.

JOHN ROUSH
Methods Engineer
Ryan Aeronautical Company

BENEFITS of $20,000 a month can accrue from a new compressed air program launched at Ryan. Developed from an extensive survey, the new program outlines the method for obtaining maximum efficiency from air-operated tools—with minimum maintenance. Tests show that these savings can be realized from increased production and reduced operating costs.

Because it is a silent, unseen source of power, compressed air is too often taken for granted. Yet it is a potent production force which deserves expert analysis. For instance, at Ryan, 680 horsepower is required to compress the air used by air-powered tools. Economically, too, the use of compressed air at Ryan involves substantial amounts. More than $2,000,000 a year in wages is paid to those employees using air-operated tools. In addition, an amount of $82,600 yearly is expended for parts and labor required to keep the $300,000 worth of air-operated hand tools in good operating condition.

It was deemed advisable to undertake a detailed analysis of compressed air operations. Started several months ago, by the methods engineering department, this study has been completed and the recommendations made are being carried out.

Developed under the direction of the Methods Department, this survey disclosed some interesting things with respect to the tools, distribution lines, and sources employed in the compressed air activity.

Tool Maintenance

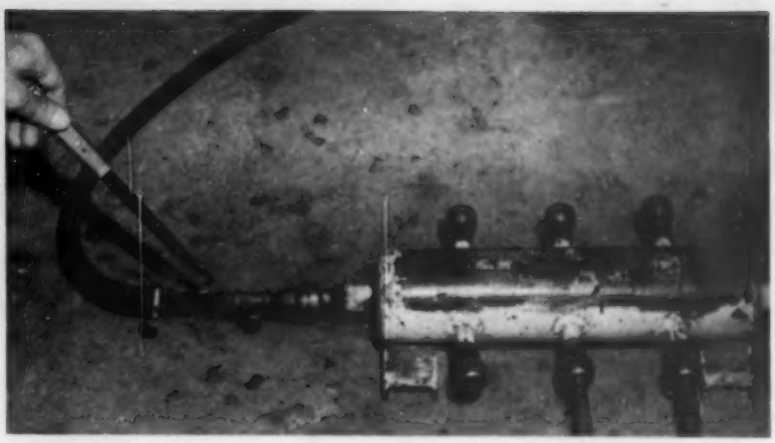
In most tools, such as drills and grinders, the only parts which should wear under proper use are the rotor blades. However, it is mandatory that the tools be regularly lubricated. When lubrication ceases, tool damage begins. One damaged or worn part soon affects others and expensive gears and bearings become involved. The cost of rehabilitating a tool which has broken down because of defective lubrication may run between $50 and $75.

It was shown by the survey that expensive tool repairs could be avoided in almost every instance if

a system were adopted which insured regular lubrication and testing. In order to accomplish the lubrication and testing of tools without discommoding production, a mobile test cart was devised. Equipped with test instruments and oiling devices, these carts travel through the factory to bring the test facilities to the tools in use.

Every Ryan air-operated tool is tested each week. First, the tool is checked on the test cart's tachometer to determine its speed. Then, a flow meter check is made to analyze its air handling capacity. By harnessing the tool to a hydraulic pump which pumps oil against a pressure gauge, a good idea of the power which the tool develops is obtained. Finally, the tool is oiled. If defects show up in the tests, the tool is sent to the repair station.

In conjunction with the Ryan development laboratory, a special test is being conducted to determine if molybdenum disulphide can be used as a tool lubricant. If this compound stands up as well as preliminary tests indicate, it will be possible to clean and re-lubricate the tools without disassembling them. With the standard greases now used in tool bearings and gears, this cannot be done because the cleaning solvent washes the lubricant away. The tool then has to be taken apart and re-greased. If molybdenum disulphide proves to be satisfactory, the tools can be serviced completely at the test cart without having to be disassembled, since this lubricant is not dissolved by cleaning solvents.



Ryan engineer points to undersize ¼-in air line feeding a six tool header. Also, drain cock at right has been replaced by plug, which prevents draining.

One of the Ryan-designed test carts which are used throughout the plant to test and maintain all air-operated tools and air lines on a regular schedule.

Distribution Lines

Ryan factory buildings, covering over 750,000 square feet of space, are adequately served with compressed air. The desired objective is to see that a full 90 psi pressure is delivered to each hand tool. A tool will lose power if air pressure drops below 80 psi and undue wear will result if pressure goes above 110 psi. Power loss can materially affect production output. Ryan found that a typical tool could produce 18 parts at 90 psi but only 14 when air pressure dropped to 70 psi.

One of the most revealing aspects of the Ryan survey was the pronounced effect which fittings and hoses have upon tool performance. Ryan uses 3000 quick-disconnect type fittings. These should be inspected at regular intervals. After months of service, the rubber washers and metal valves in them can become worn and will greatly restrict air passage. The effect on tool operation is shown in Table I.

By specifying the best type of fittings, these losses can be held to a minimum. The pressure drop through a good quick-disconnect fitting and valve is only three psi, or five percent of tool efficiency.

A number of instances of power loss due to improper size and length of hose were uncovered by the study. The smallest inside diameter rubber hose recommended by air tool manufacturers is 5/16 in. Often 1/4 in. hose sizes are used, and no consideration is given to lengths employed. In some cases it was found that 25 feet of hose were used to serve a work station only six feet from the

TABLE I — PERCENTAGE OF TOOL EFFICIENCY -- TEST RESULTS

Line psi	With old valve and washer	With new valve and washer	Percentage efficiency increase
95	48%	100%	108%
98	80%	100%	25%
95	6%	90%	1,400%
100	27%	88%	225%
102	5%	100%	1,900%
*80	25%	56%	124%
*85	41%	56%	36%

*Low line pressure

air outlet. A gain of two psi was made by merely uncoiling such hose.

A typical situation which can occur is one in which a 1/4-in. hose from an air outlet is plugged to a hose of larger diameter which, in turn, is connected to two or more whip hoses for tools. Here, the capacity of every tool is limited by the first undersized hose and further reduced by the lengths and multiple fittings used. Tool efficiency was increased 42 percent by merely removing the first hose. Examples of the gains made by substituting 3/8-in. diameter hose for 1/4-in. are shown in Table II.

Branch Lines and Fittings

Basically, Ryan's main compressed air lines were found to be adequate but branch lines were sometimes improperly arranged. For instance, it was found that 3/4-in. overhead plug strips were fed by 1/4-in. branch lines. In one case a greatly extended branch line was feeding 34 outlets even though another source of air was close at hand. A common practice was to put the tool fitting at the bottom of the feed pipe, tending to make a water trap out of the outlet.

Ryan uses a good many manifolds, or "pigs" which consist of a short length of 3-in. diameter pipe with a main inlet in one end plate and a drain cock in the other. Six fittings are installed in the barrel to serve tools. Tests showed that these "pigs" could function efficiently when connected to branch lines through 3/4-in. hose and ½-in. pipe fittings. Without proper supervision, these units are often converted so that they do not meet these requirements. Sometimes, the drain cocks are removed, and a plug or another air fitting is inserted in its place so that they cannot be drained.

As a direct result of the study, Ryan has standardized on the use of Hansen fittings and 3/8-in. diameter hose lines of the shortest possible run to each work station. All fittings are inspected at regular periods and worn valves and washers replaced. Tapered valves have been replaced with square shoulder valves which permit an average of 14 percent more air to pass. Care is taken to see that not more than 10 Hansen fittings serve a 1/2-in. pipe inlet, and hook-ups are distributed in as balanced a manner as possible. "Pigs" have been served with proper sized hose and fittings and drain cocks have been re-installed.

These steps have increased tool power as much as 200 percent and have made more compressed air available to the plant. This may sound paradoxical in view of the fact that larger air lines require more air to keep them supplied. As a matter of fact, methods engineers estimate that it takes 35 percent more compressed air to fill the system now because of the enlarged hoses and fittings. However, with full power at each tool, the production jobs are accomplished in a fraction of the time formerly needed with the result that more air power is available to the plant.

TABLE II — EFFECT OF HOSE SIZE ON EFFICIENCY

Line psi	Tool efficiency ¼" I.D.	Length	Tool efficiency ⅜" I.D.	Length	Percent increase
106	76%	12'	100%	12'	31.5%
94	33%	20'	92%	12'	178.7%
94	49%	14'	92%	12'	87.7%
98	46%	14'	90%	12'	95.6%
94	67%	8'	92%	12'	37.3%
100	36%	15'	100%	12'	177.7%

Compressors

Four compressor stations are located in the plant to provide the necessary compressed air. Five Gardner-Denver compressors and one Worthington are used to develop 3600 cfm at 100 psi. The survey showed that this air entered the main lines of the plant at 100 F. As it coursed through the plant and into the hand tools, it cooled, and moisture in the air condensed within the system. This water caused rust which flaked off and was blown into the tools. The moist, dirty air entering the tools removed the lubricants and introduced foreign abrasive matter which contributed to excessive maintenance costs.

By improving the design and use of water trapping facilities, Ryan improved this undesirable condition. However, the survey recommended that steps be taken to remove the water from the air before it entered the distributing system. This has been done at one compressor station and is being planned for the others. A Parkhill-Wade air drier has been installed to remove the water content from the air. By means of a triethylene glycol solution, through which the compressed air is flushed, two-and-a-half gallons of water per hour are being removed.

Summary

To summarize, the basic benefits which the Ryan survey and the newly created procedures have produced are:

A desirable decrease in the cost of repairs to Ryan's 4000 air-operated hand tools.

A marked increase in the efficiency of these tools resulting in faster, better work and equivalent to increasing the work force.

An extension in the life of Ryan's $300,000 worth of tools.

A stepped up availability of these pneumatic tools due to better service and reduced periods of out-of-service, equivalent to raising the number of such tools.

An increased availability of compressed air power within the plant equivalent to installation of added facilities. This is important because Ryan uses close to installed compressor capacity.

A total potential saving of $20,000 a month when all of the recommendations of the report have been accomplished.

Paper treated with the chemical vapor phase inhibitor is used to tape up the openings in this mixing equipment machinery to prevent corrosion during the interval between shipment and actual installation.

Rust-Proofing Stored Equipment

I&P EXCLUSIVE

A chemical inhibitor to prevent corrosion of machine parts, in transit and prior to installation, has given excellent results.

A LARGE SOUTHERN UTILITY company has been using a chemical inhibitor to prevent corrosion where rust-preventive oils cannot normally be used. They selected a vapor phase inhibitor, commonly referred to as VPI, to guard against internal corrosion of new boiler parts between the time they arrived at the construction site and the time they were erected. Furthermore, on a recent addition, faced with a 229 day delay between initial hydrostatic test and actual operation, the utility used the inhibitor to protect the boiler during this idle period.

As the tubes and headers were received, strips of VPI paper were put inside the tubes and the openings stoppered with wooden plugs. The single 72 in. (inside diameter) steam drum was protected with a full 36 in. width of treated paper the length of the drum, laid inside. The paper was removed from each part just prior to assembly.

The initial hydrostatic test on this boiler was made in April, 1952. Immediately after the test, the boiler was treated with VPI powder. The calculated internal volume was 4,400 cubic feet. Fifteen grams of the powder were recommended per 1,000 cubic feet of volume. Fifty percent of the charge was specified for the drum and 12½ percent for each of the lower headers.

The powder was applied with a "bug-duster," an agricultural device designed to put insecticide powders on vegetation. Using the "bug-duster," the powder was blown into every accessible opening of the boiler immediately following the hydrostatic test. The recommended amount of powder was increased by 200 to 400 percent, since all told this represented only half a pound.

Developed and marketed by the Shell Oil Co., VPI is available in liquid and crystal form, as well as a coating for wrapping paper. It is being used to supplement rust resisting oils, as the sole means of protection in other cases, and to provide protection in applications where rust-preventives cannot be used. VPI can be safely used only to avert corrosion if used with ferrous and aluminum alloys. If used in the presence of cadmium, zinc, babbitt and other metals it has a deleterious effect. This limitation of VPI merits

VPI crystals are sprayed into gear reduction units through the oil hole. Vapors are confined by sealing all openings.

careful study for each application.

The utility company's Chemical Engineer commented to the effect that, "this boiler is the fourth of a series of almost identical Foster-Wheeler units put in operation in the last six years, and even though this last boiler stood with all surfaces wet and in contact with air longer than had any of the other three, the corrosion was very much less. The surfaces of the drum of the headers and of the tubes, as far as we could see into them, showed relatively little corrosion and the accumulation of corrosion products in the lower headers on the first shut-down after initial operation was much less than it had been in the case of the other boilers."

Pump Protection

One result of this test was that the utility requested Ingersoll-Rand Co. to furnish the boiler feed pump for another new unit, then in the initial construction stages, without any of the usual grease. The pumps were to be protected only with a VPI solution. It was a novel experiment but well justified by the results.

The application procedure for this pump, an eleven stage double casing unit, was developed jointly by Ingersoll-Rand and the Shell Oil Co. The interior of the pump was completely filled—to ensure that the solution reached all parts of the pump—with a 4 percent (saturated) solution of VPI in water. The pump shaft was turned over once or twice and then the pump was upended to decant slightly more than half of the solution—leaving its level, at the time of shipment, just under the centerline of the impeller shaft. All pump openings were closed with gasketed blind flanges.

The solution was mixed in the Ingersoll-Rand plant and put into the pumps after the hydrostatic tests. About 50 gallons of the solution were required to protect the eleven stage pump; or from 15 to 16 lbs of solid VPI crystals.

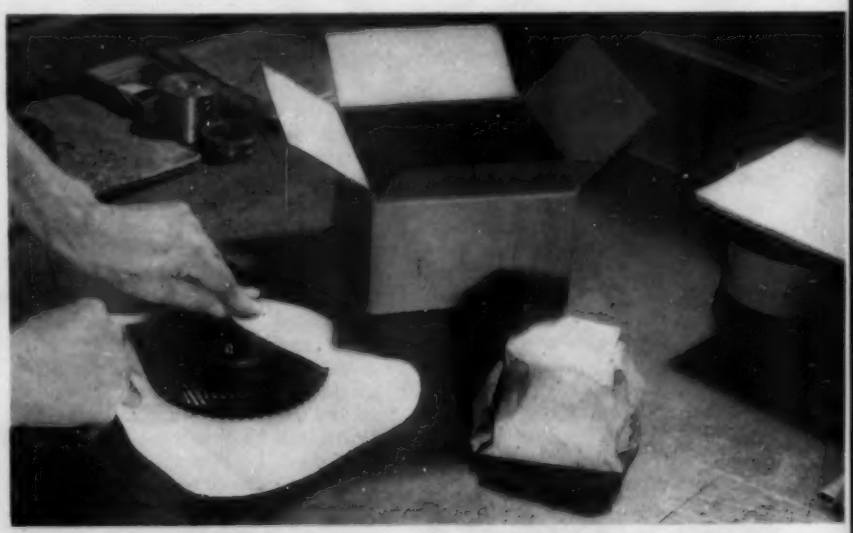
Compressor Piston Pins

A second corrosion problem was resolved for Ingersoll-Rand by shipping ground and polished compressor piston pins in treated paper. Previously, these parts had been shipped with a heavy rust-preventive grease. However, on occasions, the parts were being received by the customer in a rusted condition. Wrapping the piston pins in VPI-treated paper, without any rust-inhibiting grease, seems to have given satisfactory results.

Experiences at Mixing Equipment

Of equal interest is the experience of the Mixing Equipment Co. of Rochester, N. Y. This company is the largest manufacturer of fluid mixing equipment in the U. S., selling units from 1/30th hp to 500 hp.

In June, 1951, this company shipped twelve of their units, cost-



Spare parts are wrapped in treated paper after a dip in polar type oil. Sealed packages are considered to be protected for up to three years.

ing approximately $12,000 each, to a water and sewage treatment plant in Texas. Because of plant installation delays, this equipment was allowed to stand unprotected in the open for about twelve months before being put into operation. Immediate bearing and gear failure resulted. Opening the gear reduction units for inspection, it was found that gears, shaft, and bearings were heavily coated and pitted with rust, in spite of the fact that the company had protected the surfaces with a polar type corrosion inhibiting oil. The customer held the Mixing Equipment Co. liable and eventually all equipment was replaced at a considerable loss to the company. This experience led to the investigation of the VPI method of corrosion protection and to the establishment, in August, 1952, of a procedure designed to eliminate any further recurrences of the same situation.

Since that time, the company has processed over 2500 units with VPI powder and treated paper. To date there have been no further customer complaints or losses.

Measured amounts of crystals are stored in these glass containers. Operators simply select proper container and spray entire amount into the unit.

Protective Procedure

The procedure for VPI protection as detailed by Richard Boutros, Chief Engineer of the Mixing Equipment Co., is that during assembly, any and all carbon steel and iron parts added to the speed reducer assembly internally (such as change gears and change gear covers) are coated by dipping or brushing in polar type oil, and the excess allowed to drain. This method replaces the run-in procedure previously used. Any parts or locations formerly coated with white lead and lubricating oil, are treated in the same manner with polar type oil.

Bearing Assembly

The floating bearing assembly is dusted with VPI immediately prior to assembling the floating bearing unit member and the speed reducer housing. Suitable shakers are supplied for this purpose. The bearings are lightly but wholly covered with VPI. In the same way, the fixed bearing assembly is dusted with VPI. Immediately after dusting, a cover is put in place to confine the vapor in the unit.

Upon completion of assembly, but prior to painting, the assembly department sprays a pre-determined amount of VPI into the speed reducer units. Spraying of all units is done by means of a DeVilbiss Flock Gun. The Flock Gun uses a cylinder of compressed oil pump nitrogen, instead of compressed air, as a propellant. Since oil pump nitrogen is extremely dry, it will not dampen the VPI, causing it to cake. The input shaft is rotated slowly by hand while spraying the unit.

The assembly department is supplied with glass containers calibrated and marked for the various speed reducer unit sizes to be sprayed. These containers are filled to the bottom level of the tape; packed loosely—not compacted. There is an adequate factor of safety included to compensate for variations in filling. The glass containers are filled from the VPI storage container and are kept covered and away from sunlight and artificial light.

During Painting

The units receive the usual type of paint on the speed reducer housing, bearing members, motor and motor brackets, unless otherwise specified. External carbon steel or iron parts of the mixer units such as the shaft, shaft coupling, motor coupling, input shaft and adapter sleeves are sprayed with rust-preventive oil as done in the past.

The shipping department wraps the unit with VPI wrapping. The fixed bearing housing is completely wrapped with a sheet of VPI wrapping, inhibitor coated (or white side) towards the shaft, attaching the paper securely to the housing by means of a suitable tape. The fixed bearing housing drainage grooves are covered with tape. Similarly, VPI paper is wrapped around the input shaft and taped to the coupling and speed reducer case. Paper is wrapped over the oil dip stick and taped to the speed reducer case. The mixer shaft is wrapped at the floating bearing assembly, taping the VPI wrapping to the shaft and to the floating bearing unit member.

When crating and shipping, care is exercised not to tear or puncture the VPI wrapping.

In cases where the protected equipment may be stored out-of-doors for six months or more, it is the policy of the Mixing Equipment Co. to write to the customer, detailing the corrosion preventive measures taken, and offering to supply additional quantities of VPI to ensure that no corrosive damage will result to the equipment.

The company also protects its spare parts with a wrapping in VPI paper after a hot dip in ethyl cellulose. This procedure guarantees protection up to three years, regardless of storage conditions.

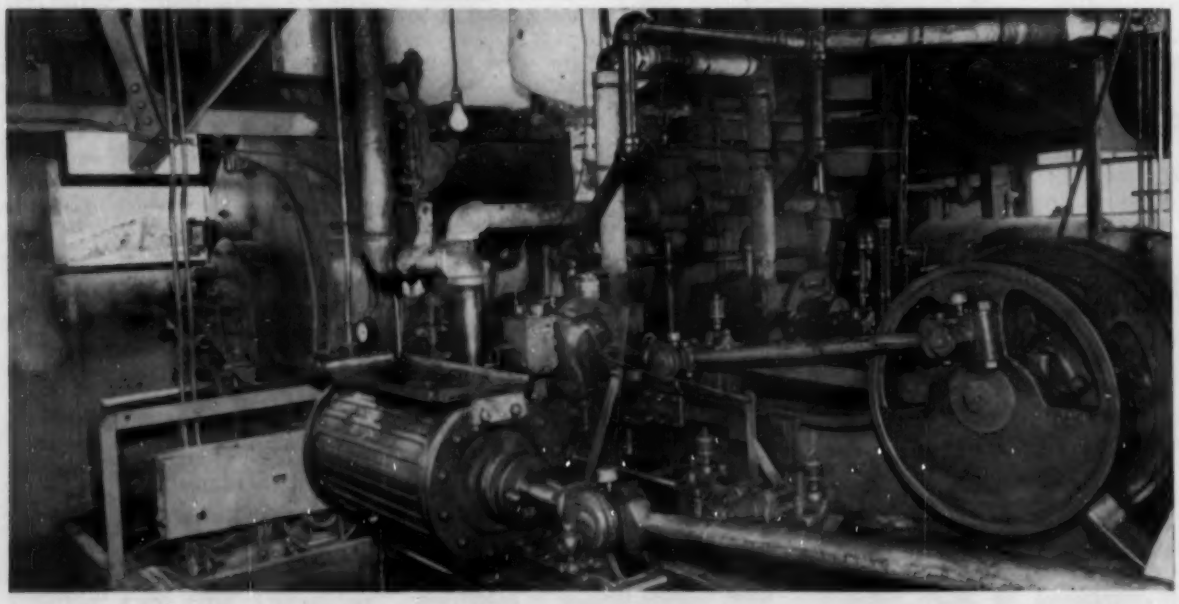
Package Boiler Powers Crane Hoist

RICHARD LANGBEEN
Superintendent
Newark Plaster Co.

A 60-ft high traveling crane picks up gypsum rock and empties it onto a conveyor which carries the material into the plant.

APPLYING proved principles, brought up to date with equipment of modern design, is not only good engineering—it's good business. For example, Newark Plaster Co. recently installed a Cyclotherm package steam generator in a traveling crane for supplying steam to a Mead-Morrison engine which drives a hoist. In this instance, both the portable feature and the service requirements mirror similar conditions in the transportation and construction fields where fire tube boilers have been utilized for many years. At this plant, however, improved equipment with modern controls assures high efficiency over a wide capacity range and provides automatic operation.

At Newark Plaster, gypsum rock arrives at the plant's dock by ship or river barge during a period extending from late April to early November. This material is picked up by a 60-ft high traveling crane, mounted on rails that run the full length of the dock, and is emptied onto a conveyor which transports it into the plant. The crane's lift bucket has a 1¼-cu yd capacity when full, and under normal conditions 70 tons are unloaded per hr. Peak capacities of 135 tons per hr have been reached under favorable circumstances, but such performance is unusual since the gypsum rock ranges in size from



Steam for the Mead-Morrison engine which drives the plant's hoist is supplied by a Cyclotherm package steam generator.

5-in. bulk to powder fine, and handling is frequently difficult.

Success of the unloading operation depends on a reliable source of steam supply for the hoist engine. Thus, a consulting engineer was retained to determine the proper type and size of equipment that would satisfy the plant's widely varying load demands. A 125-hp package boiler designed for 150-psig pressure was specified and installed. This unit supplies steam exclusively for the hoist engine and normally operates at 120-psig pressure.

Service Lines

Since the generator is mounted on the crane adjacent to the hoist engine, considerable ingenuity was required in the arrangement of auxiliary equipment. A 500-gallon fuel oil tank was installed on the crane, and a reserve storage tank of 2000-gallon capacity was buried in the ground next to the plant. Oil is transferred from the buried tank to the tank on the crane through a flexible hose line using a booster pump at ground level.

Another flexible hose line is used to carry water to a storage tank on the crane, with the necessary booster pump (installed at ground level) taking suction from the city water supply lines. Exhaust steam is employed for preheating the feed, and a steam expansion tank with a water separator is fitted on the boiler because of the severely fluctuating load demand.

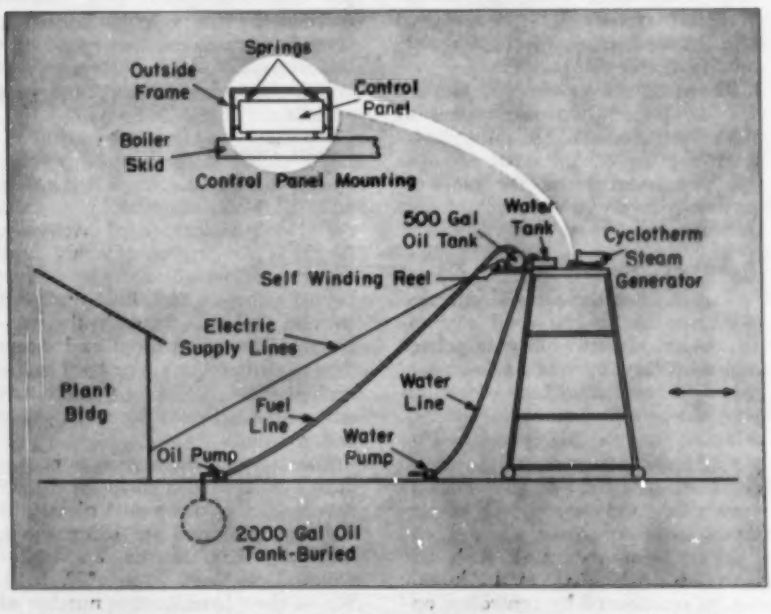
With this arrangement, both fuel and water can be supplied on an intermittent basis. However, since the package steam generator is automatically controlled, it is necessary to have a continuous supply of electric power. To cover this contingency, a self-winding reel was mounted on the crane. This reel keeps the electric supply lines taut at all times regardless of the position of the crane with respect to the source of power supply.

When the crane moves, a self-winding reel keeps the electric power lines taut.

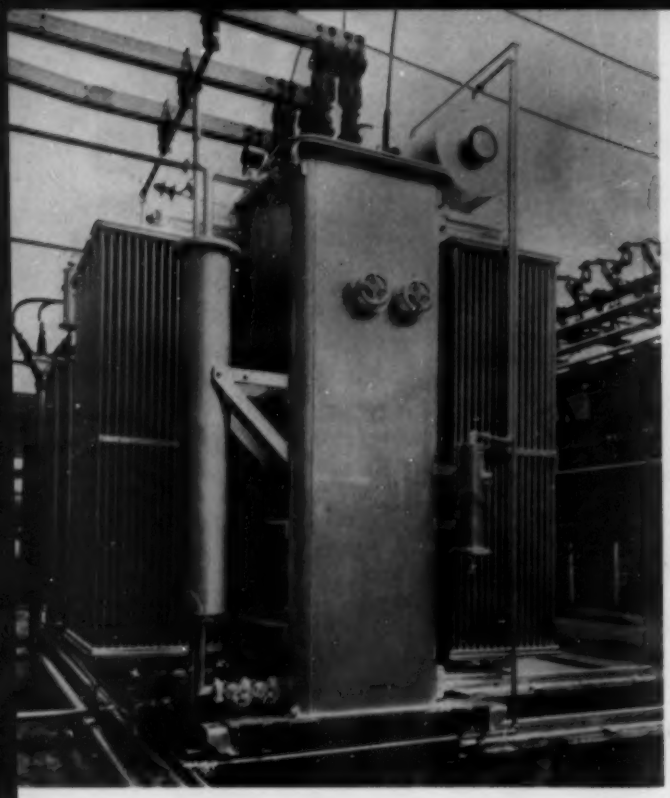
When the package steam generator originally was installed in the crane, some difficulty was experienced during the initial operating trials. It was found that the lift bucket, filled to capacity with gypsum rock, caused excessive vibrations and shock. These vibrations were transmitted back to the boiler controls, causing the electric relays to fall out of position and shut down the unit.

Newark Plaster Co. personnel working in cooperation with Cyclotherm service engineers devised an effective arrangement for eliminating this difficulty. An angle iron frame was erected on the structural steel boiler base, and the entire control panel was spring suspended within the frame. With this arrangement, shock and vibration are absorbed by the external frame with springs cushioning the effect on the control panel. The control panel itself remains stationary, and no further trouble has been experienced.

At the present time, two seasons of operation have been completed with this unit. The boiler was inspected following the first season's operation and was found to be extremely clean, with no evidence of any internal scale deposits or abnormal fireside accumulations. Newark Plaster is very pleased with the results, particularly in view of the severe service conditions which call for a tremendous drainage of steam when lifting a full bucket followed by periods of much lighter load demand.



This drawing shows the main service lines and special control panel mounting.



Preventive Maintenance for Power System Oils

J. ELMER HOUSLEY
District Power Manager
Alcoa, Tennessee Works
Aluminum Company of America

Substantial cost reductions can be realized by instituting a preventive maintenance program for transformer oils using Activated Alumina.

Cylinders showing in front of transformer radiators are bypass treater (left of case) and breather (right).

PREVENTIVE MAINTENANCE programs for power system oils offer substantial savings in the operation of transformers, oil circuit breakers, and power house equipment. Air and moisture are the principal enemies of power equipment cooling and insulating oils. In time, they will cause the oil to deteriorate. When oils begin to deteriorate, acids are formed which attack and corrode the power equipment. Further deterioration of the oil produces sludge, which impairs the cooling action of the insulating oils in transformers. In addition, water forms as an oxidation product and cuts down the insulating properties of the oils; it also promotes the attack on metal parts by water-soluble acids. These factors shorten the life of power equipment and increase maintenance costs.

What has not been generally recognized is the fact that this oxidation or "wear" can be inexpensively prevented. By treating power system oils with Activated Alumina, they can be continuously maintained at top quality far beyond the life of the power equipment.

Dollars Saved

It is less expensive to preserve oils with Activated Alumina than it is to replace them periodically with new oils. At the Alcoa, Tennessee Works of Aluminum Company of America, the power system required an expenditure of $6500 for 30,000 gallons of replacement oil once every 5 or 6 years. The Activated Alumina preventive maintenance program required an outlay of $5000 for equipment and alumina to prevent the need for this new oil from ever recurring. The program, when carefully applied to a power system, actually costs less than $0.01 per gallon of oil per year. Even greater savings are those resulting from increased equipment life, reduced equipment maintenance, and reduced down-time for repairs.

There is more than one method for the preventive maintenance of power system oils. To date, however, the use of Activated Alumina has been found to be the most effective from the standpoint of cost and efficiency.

Adsorbing Ability

The characteristics of Activated Alumina that fit it for oil maintenance include its ability to adsorb and retain an appreciable amount of moisture or acid without objectionable changes in form or properties. Alumina has a high compressive strength and resistance to shock and abrasion. It is chemically inert to most gases and vapors, and it furthermore is non-toxic.

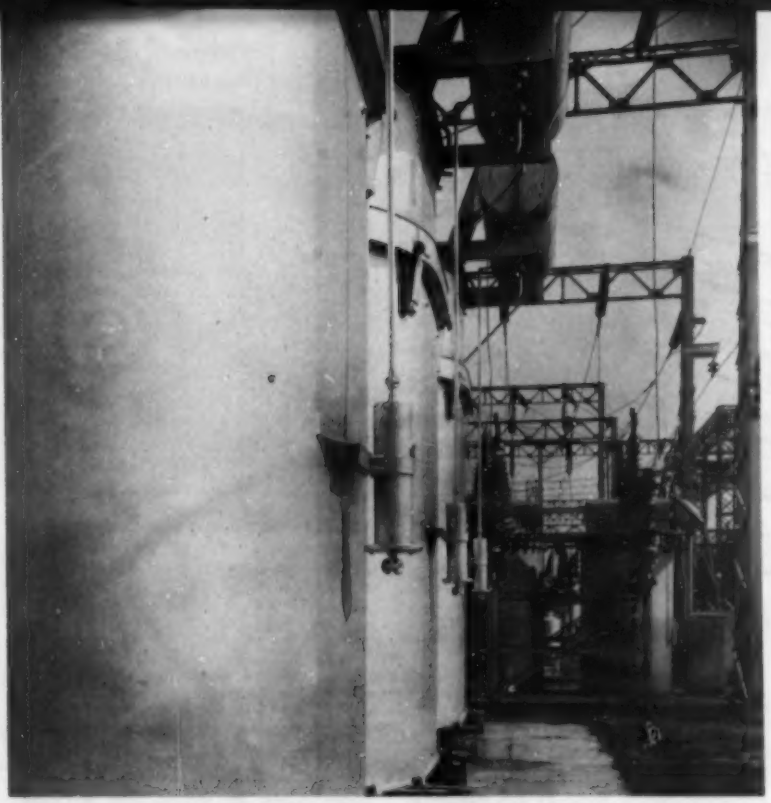
After being saturated with adsorbed material, Activated Alumina can be reactivated by controlled application of heat. (Alumina used for oil treatment should not be used for adsorbing moisture after it is once reactivated, but it can be continually re-used for oil treatment.) Finally, Activated Alumina is a pure chemical compound in contrast to the varying and oftentimes unknown composition of the activated clays sometimes similarly used.

Most transformer types can be adapted to the Activated Alumina preventive program with relative ease. This requires putting existing units in a clean and low-acid condition, installing bypass treaters and breathers, and setting up a testing schedule.

Bypass Treaters

The bypass treater is an externally located cylinder containing perforated cartridges of Activated Alumina. Adsorption of acids from the transformer oil occurs by contact between the oil and the alumina as the oil diffuses through the cartridges. The oil is circulated either by a centrifugal pump or by thermo-syphon action utilizing temperature differences between the transformer and treater.

The normal maintenance procedure of reconditioning actually makes up the major part of installing the program on older units; thermo-syphon treaters can then be attached to them (over 100 kva). Where the neutralization number of the transformer oil is near 0.20, an



This installation of breathers shows how they can be mounted on the side of the tank; all air entering reservoir tanks passes through breathers first.

Activated Alumina bypass treater sometimes can be applied with no special preparation of oil or of the transformer. Normal operation will soon bring the neutralization number down to a safe level (below 0.15). If inspection shows sludge in the transformer, it will be necessary to first clean the oil, core, and tank.

If the neutralization number is between 0.20 and 0.50, the acidity can be reduced by passing the oil through a bed of Activated Alumina on its way back into the transformer after the cleaning is complete. The maximum flow rate should be 0.10 gallons per hour per pound of Activated Alumina.

Batch Treating

If the neutralization number is above 0.50 it may be necessary to batch treat the oil while in a storage tank. Large, open-type treater tanks hold the Activated Alumina; these tanks are usually made from discarded transformer tanks or 12-inch pipe. The amount of Activated Alumina needed to process a given amount of oil can be estimated by using the chart shown in Fig. 1.

As an example, 3300 gallons of oil with a neutralization number of 0.70 are to be treated to achieve a final number of 0.20. The weight of a gallon of oil is approximately 7.5 pounds. The 3300 gallons, therefore, weighs 24,750 pounds. Referring to Fig. 1, the line representing an initial acidity of 0.70 is found at the bottom; it is traced vertically to the intersection with the curve marked 0.20. This point of intersection is then traced horizontally to learn that the weight of Activated Alumina needed is 3.8 percent of total weight of oil. Therefore, 940.5 pounds of alumina are needed. (Although this is a large initial amount, the alumina can be reactivated and re-used.)

New transformers require a somewhat different approach. Most new transformers can be purchased equipped with bypass treaters or fittings. Transformers of the air-over-oil type in sizes 200 to 1000 kva can be purchased equipped with the treaters. Conservator-type transformers in sizes above 500 kva are available equipped with treaters.

Test Schedules

A test schedule should be set up so that an accurate check can be made on oil condition for the purpose of beginning treatment, and also to determine later when the Activated Alumina in a treater needs reactivation.

Service and operating conditions may make it necessary to place a thermo-syphon treater in service at the time a new transformer is energized. Normally the neutralization number of the oil in a new transformer will not increase until the inhibitors in the oil have been consumed. In some cases, however, the neutralization number will be increased by undesirable varnish products or by a reaction between varnish, oil, and residual moisture in the windings. New, not reactivated, Activated Alumina should be used in the initial installation to efficiently remove moisture.

Check Deterioration

When the neutralization number of the oil in the new transformer reaches 0.15, the bypass treater is placed in service even though the transformer may be new and the treater has not been used before. The alumina is then changed when the number again begins to go above 0.15. Annual or semi-annual tests are necessary to determine the rate of deterioration in new transformers.

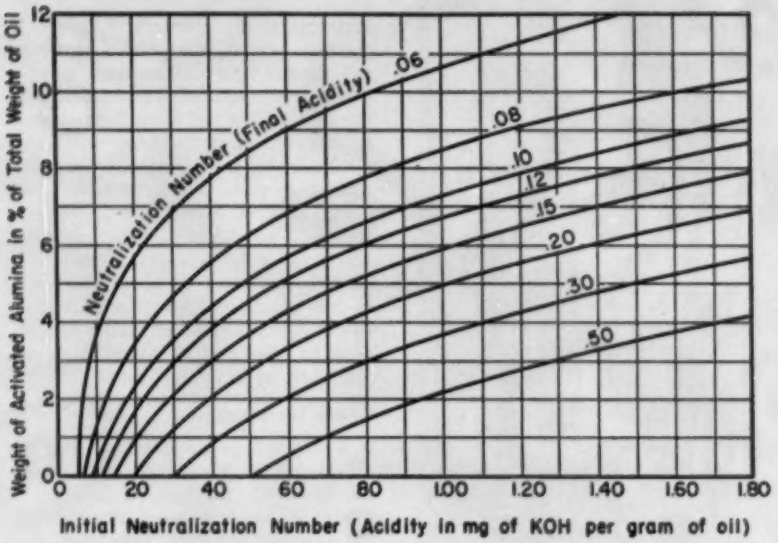
Transformers in sizes of 100 kva or smaller can not be practically equipped with bypass treaters. For this reason different treatment methods have been applied to bring Activated Alumina in contact with the insulating oils. Canvas bags or perforated metal cans of alumina are hung in the oil inside the transformer, but out of contact with live parts.

Bags for Alumina

The bags are made in a cylindrical shape of light-weight duck cloth or unbleached sheeting cloth. Any medium-weight, untreated canvas will be satisfactory for the containers. The diameter of the can or bag should be small enough so that it does not completely fill the space between the transformer core and the transformer case. The container length can be from 12 to 24 inches depending on the amount of alumina needed and the number of containers used in the transformer. If necessary, one may be put in each corner.

The container should be hung in the transformer so that its top is a few inches above the top of the iron core. In this position, the bags will have the least opportunity to rub against live parts such as flexible leads and terminal blocks.

Care must be taken to see that cloth bags holding the alumina are inspected at least once a year. The cloth may rot and cause the alumina to spill in the transformer. A bag should be replaced when a blunt



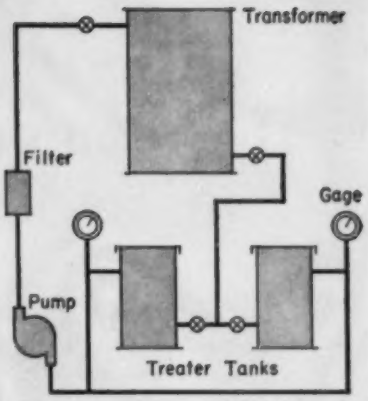


Fig. 1—Schematic diagram (above) shows use of treating equipment with open tanks; graph at left tells required amounts of alumina.

wood stick will punch a hole in it. Perforated metal containers are often preferred because they are more durable than cloth.

The conservator-type transformer is designed to decrease the contact of the insulating oil with outside air. As a result, the acidity will increase at about one third the rate of a comparable air-over-oil type transformer. For this reason, a conservator-type transformer with high quality oil will operate for 10 to 15 years before sludge begins to form. When poor oil is used, however, treatment of the oils may become necessary in a much shorter time.

Valve Blanks

In large transformers of both types, manufacturers will install radiator valve openings with blank covers over the openings. In these cases the purchaser may buy or fabricate his own treater and attach it at the valve openings.

Older units should be tapped near the top and bottom of the tank and equipped with valves, if valves do not already exist in suitable places. A bypass treater can be attached at these points. Where cold cooling water is available, oil can be kept so cold in a transformer that circulation will not take place through the treater, and a reduction in cooling water is necessary to allow the thermo-syphon to operate.

Transformers equipped with gas-over-oil equipment employ a cushion of inert gas above the surface of the oil to prevent oxidation and moisture pick-up. This greatly prolongs the sludge-free life of the oils, but is not foolproof. If the gas pressure is not maintained properly and oxygen is allowed to enter, oxidation will occur. In addition, insulating oils will deteriorate at elevated temperatures in contact with metal, varnish and other catalysts, even in the absence of oxygen. For these reasons, the neutralization number and interfacial tension of the oil in these transformers should be checked annually.

Alumina Breathers

A transformer constantly exhales and inhales air as the volume of oil inside expands and contracts. Serious contamination of the transformer coil by the moisture-laden air could result from this breathing action. Reactivation of oil-soaked Activated Alumina from bypass treaters reduces its water-adsorbing properties; to maintain control of moisture within the transformer a breather is attached to dry the air which may come in contact with the transformer oil during its operating lifetime. The breather is a canister filled with Activated Alumina; it is attached to the transformer by a pipe leading to the upper air space. Breathers are available which hold 20 pounds of the alumina; this will dry all of the air that would come in contact with the oil surfaces.

The breather forces air moving into the transformer to pass through Activated Alumina, which removes the moisture. In all normal applications, this alumina breather will eliminate the expensive need for drying transformer oil in a blotter or by centrifuge methods.

Breathers are attached to air-over-oil transformers through any pipe opening on the side of the tank that is an inch or more above the maximum oil level, or from any pipe opening on the cover plate. Another way would be to attach a tee connection at the top of the oil gage glass to which the breather pipe is connected. If none of these openings is available, it may be necessary to drill a ¾-inch hole through the side of the tank near the cover plate. A breather connection, such as a 1-inch IPS female boss or 1-inch IPS pipe coupling, can then be welded to the hole.

New transformers already equipped with breathers can be purchased from many manufacturers. However, breathers are not used for distribution transformers, for certain free breathing transformers, or for other special types that cannot be satisfactorily equipped.

Conservator Tanks

To improve the advantage of the conservator-type transformer, an Activated Alumina breather should be attached to the reservoir to dry the air contacting the oil in the conservator tank. This practice will keep the oil in the transformer sufficiently dry so that moisture will not condense in the explosion vent and drip onto the core. Also, corrosion will not occur in the explosion vent pipe and in the pipe from the conservator to the transformer. The explosion vent pipe is connected to the top of the transformer tank and should be filled with oil to exclude oxygen, which would at the same time exclude moisture at this point.

Conservator tanks are usually equipped with a sump to trap any free water taken from the air by the tank's breather action. This free

Workman is removing Activated Alumina can from a thermo-syphon bypass treater; since man is above transformer, it must be de-energized for this work.

water is eliminated when an alumina breather is attached.

New conservator-type transformers should be purchased equipped with breathers that will hold 20 pounds of Activated Alumina. Older units without breathers can be easily equipped.

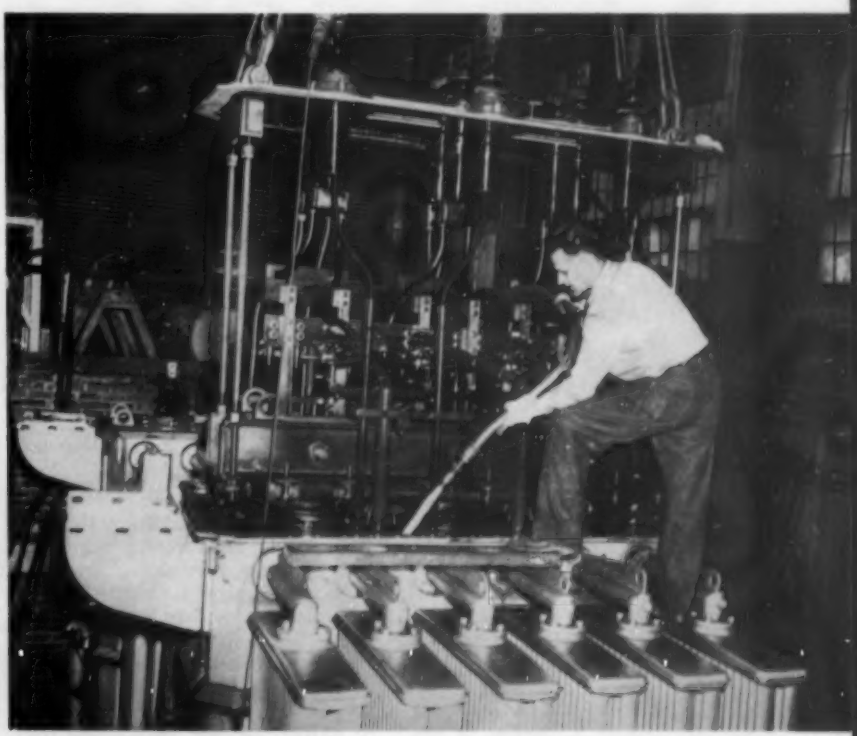
In addition, some new units have oil filled bushings that are equipped with breathers. If not so equipped, but if there is a breather vent to the outside air, a sack of alumina should be placed in the bushing for protection against moisture.

Documented Experience

Once bypass treaters and breathers have been installed and the oils have been restored to a good condition, experience (such as that at ALCOA's Alcoa, Tenn., works) shows that the Activated Alumina need be replaced or renewed at intervals ranging from once a year to once every five or six years. One station transformer holding 930 gallons of oil was reconditioned in 1944; at this time a bypass treater holding 40 pounds of Activated Alumina was installed. The treater kept the oil in safe condition (neutralization number below 0.15) for seven years without changing the alumina. Similar experience is quite prevalent and is well documented.

The preventive maintenance of transformer oils using Activated Alumina has been thoroughly tested and perfected over the past 20 years. As a result, it is finding increasingly widespread usage among independent power facilities and among the public utilities.

Filling a 20-pound capacity breather with dry Activated Alumina.



To get an older transformer in condition for Activated Alumina program it must be cleaned, and flushed just as in standard maintenance procedure.

Finishing cement has been troweled over the block and pipe insulation on the precipitater hoppers prior to painting.

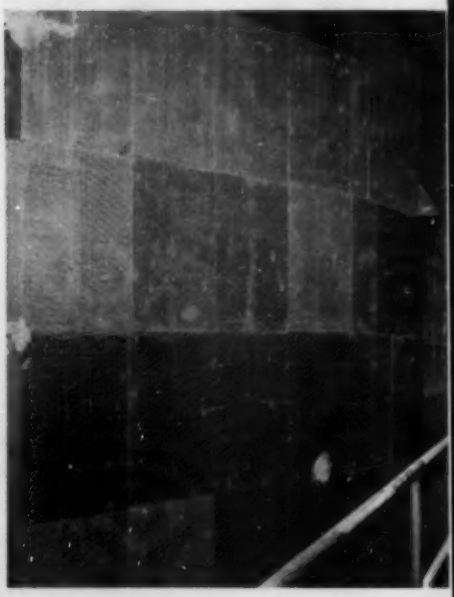
Insulation at Conners Creek

Application of insulation in some power plants is represented by as many specifications as there are types of heated equipment. The method used by Detroit Edison proves adequate and economical.

A SINGLE METHOD for applying mineral wool block insulation that lends itself to a variety of applications such as ducts, fan housings, air heaters, and hoppers of various sizes, shapes, and surface temperatures, has been developed by the Detroit Edison Company for use at all its generating stations.

This crimped-wire-and-rod method, with occasional variations, was successfully used in the application of mineral wool block insulation, either directly on the surface or on stiffeners, at the Conners Creek generating station in Detroit. It has proven economical in engineering, cost of installation, and materials.

To insulate a preheated air duct operating at temperatures between 500 F and 613 F, the workmen first tack-welded 6-gage crimped wire to the edge of each stiffener on about 6-in. centers—the stiffeners being spaced at 30-in. intervals on the duct. Then, ¼-in. rods were run between the stiffeners and crimped wire was attached parallel to the duct axis, again on about 6-in. centers. Each length of reinforcing rod was welded to the crimped wire at one end only to allow for expansion of the duct. The mineral wool blocks were tightly butted together in position over the rods with the long dimensions, vertical and laced individually to the



Mineral wool blocks covered with wire netting insulate air duct.

rods with 16-gage galvanized iron wire. At least three wires were used to secure each block. The 1½-in. thick insulating blocks in the inner and outer layers were staggered to insure as tight a heat barrier as possible.

The insulating blocks were cut to fit special surfaces such as an expansion joint. The smaller sections of insulation were attached to the expansion joint using the method described for the preheated air duct, the sections being held in place by two wires running parallel to the duct surface. All joints or openings which might become sources of heat loss were filled with mineral wool finishing cement. A layer of 1-in. wire netting was placed over the insulating blocks and laced together by tie wires. Plasterer's corner bead was applied on all sharp corners and tightly held in place by large staples. A ½-in. layer of mineral wool finishing cement was troweled over the wire mesh to form a flat, smooth surface. The insulation finish of the duct was completed with two coats of paint.

Fan Housings

The housings for primary air fans, also operating at temperatures from 520 F to 613 F, were covered with two 1½-in. layers of mineral wool block. However, in this case, the block insulation was applied directly to the surface of the fan housing rather than on stiffeners. Crimped 6-gage wire was tack-welded directly to the metal on about 6-in. centers. The lengths of crimped wire were run horizontally, spaced on about 18-in. centers. Crimped wire was also welded along each sharp corner. The insulating blocks were cut to fit on the ends of the housing and, whenever necessary, on the sides. Openings between blocks caused by the smaller curvature of the housing ends were filled with mineral wool finishing cement. As with the preheated air duct, the fan housings were later covered with a ½-in. layer of finishing cement and then painted.

Air-Heater and Ducts

Air enters the air heater at 80 F and leaves through the gas outlet duct at 330 F. The section below the ducts near the floor plate has an average surface temperature of about 650 F. Two layers of 1½-in. thick mineral wool blocks were applied directly on all heated surfaces, each block being held by at least three tie wires secured to the rods. The small sections of insulation around the expansion joint were reinforced with strips of expanded metal lath.

Versatility

The versatility of the crimped-wire-and-rod method of application is illustrated by the insulation of the small surface area of an inspection door located just below the air-inlet duct. Although only a very small section of block insulation was applied on the door, crimped wire was welded to the door surface and the insulation held in place by tie wires.

The uptake from an induced draft fan to stack ring, and a gas duct from the flue dust collector to the induced draft fan were covered with a directly applied single layer of 2-in. thick block insulation. Temperatures at these surfaces are about 275 F. Plasterer's corner bead with large staples was used on the corners of all equipment.

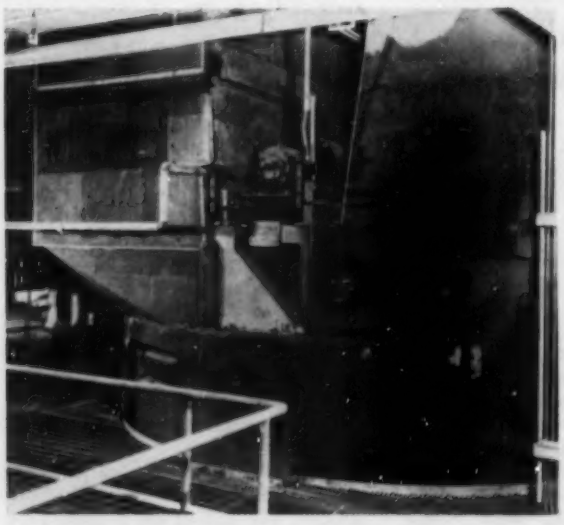
Since the block insulation was secured to the rods on the metal surface, the stiffeners extended above the top of the insulation. Half cylinders of molded-type pipe insulation were used to cover these stiffeners. The sections of pipe insulation were held in place by 16-gage tie wires joined to the crimped wire on either side of the stiffeners.

After the 1-in. mesh was wired over the insulation, both the blocks and the pipe insulation were covered with a ½-in. thick coat of mineral wool finishing cement and two coats of paint to complete the work.

Precipitator Hoppers

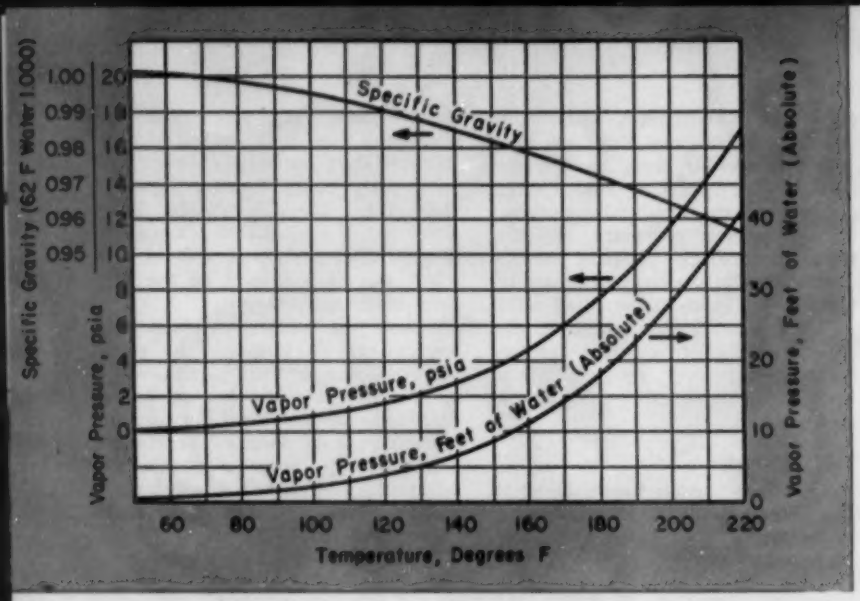
The precipitator hoppers, operating at a maximum temperature of 300 F, were insulated with a single layer of 2-in. thick insulating blocks, applied to prevent condensation in the ash rather than to reduce heat loss. The stiffeners on the sides of the hoppers were insulated in the same manner as the previously described duct surfaces.

The importance of an unbroken heat barrier on high-temperature equipment is emphasized in the care with which the comparatively small radiating areas of the stiffeners were covered at this Detroit Edison plant.



A partially insulated air heater duct shows the application details of the crimped-wire-and-rod method.

The same air duct after a ½-in. thick layer of finishing cement has been applied over the block insulation.



Vapor pressure and specific gravity curves for water. At higher temperatures, vapor pressure is especially critical and may cause pump cavitation.

Centrifugal Pumps . . .

Pump Characteristics

Among the guiding considerations necessary for the selection of a centrifugal pump are the determination, analysis, and application of suction and discharge conditions, friction losses, properties of the fluid pumped, the total heads, as they relate to the design of the specified pump.

IGOR J. KARASSIK and ROY CARTER
Worthington Corporation

PUMPING IS THE ADDITION of kinetic and potential energy to a liquid for the purpose of moving it from one point to another. This addition of energy will cause the liquid to do work, such as rise to a higher elevation or flow through a pipe. A centrifugal pump transfers mechanical energy from a rotating impeller into kinetic and potential energy to the liquid being pumped. While the centrifugal force developed depends both on the peripheral speed of the impeller and on the density of the fluid in question, the amount of energy imparted to the fluid (per pound of fluid) is independent of the fluid itself. Barring viscosity effects, the head (in feet) generated by a given pump at a certain speed and capacity will remain constant for all fluids.

The total head in a system against which a pump must operate is made up of the following components:

(1) Static head;
(2) Difference in pressures existing on the liquid;
(3) Friction head;
(4) Velocity head;
(5) Entrance and exit losses.

Static Head

Static head is a difference in elevation. The total static head in a system is the difference in elevation between the discharge liquid level and the suction level.

The static discharge head is the difference in elevation between the discharge liquid level and the centerline of the pump.

The static suction head is the difference in elevation between the suction liquid level and the centerline of the pump. If the static suction head is a negative value, the suction liquid level being below the pump centerline and being under atmospheric pressure, it is generally spoken of as static suction lift of the pump.

If either the suction or discharge liquid level is under a pressure other than atmospheric, practice varies as to whether this pressure should be considered as part of the static head or considered separately. The latter generally permits a clearer picture of the system.

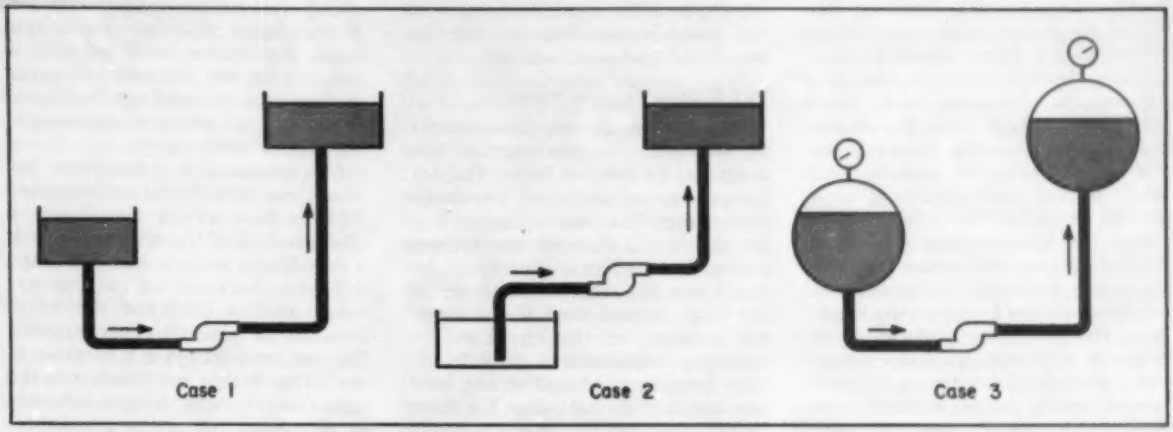
When the suction supply is taken from a closed vessel with the liquid level above the pump centerline, the difference in suction liquid level elevation and the pump centerline is commonly spoken of as submergence instead of static suction head of the pump.

Friction Head

Friction head is the equivalent head, expressed in feet of the liquid pumped, necessary to overcome the friction losses caused by the flow of the liquid through the piping, including all of the fittings. The friction head varies with the quality of flow, the size, type and condition of the piping and fittings, and with the character of the liquid pumped in the system.

Suction Supply

Except where the suction supply is from a main under pressure, as a city water main, the pump is supplied from a tank or some form of reservoir. The point where the suction pipe connects to the wall of the tank, or the end of the suction pipe projecting into the liquid, is called the entrance of the suction pipe



Case 1 illustrates the static head with the suction liquid level above the pump. In Case 2, the suction liquid level is below the pump. In Case 3, both the suction and discharge levels are under pressure other than atmospheric.

and friction loss at this point is the entrance loss. Magnitude of this loss depends upon the design of the entrance; a well-designed bell mouth resulting in the lowest possible loss.

Discharge

Likewise, on the discharge side of the system, where the discharge line terminates at some body of liquid, the end of the piping is called the exit. Generally, this exit is the same size as the piping and the velocity head of the liquid is entirely lost. In some cases, the end of the discharge piping is a long taper so that velocity can be effectively reduced and the energy recovered.

Entrance and Exit Losses

Entrance and exit losses can be considered as part of the suction and discharge pipe friction losses or they may be considered separately. Considering them separately has the advantage that it can be easily seen if either or both losses are excessive in the system.

Velocity Head

Velocity head is the kinetic energy in a liquid at any point, expressed in foot-pounds per pound of liquid or, in feet of the liquid in question. If the liquid is moving at a given velocity, the velocity head is equivalent to the distance the mass of water would have to fall in order to attain this velocity. The velocity head can be calculated from the relation:

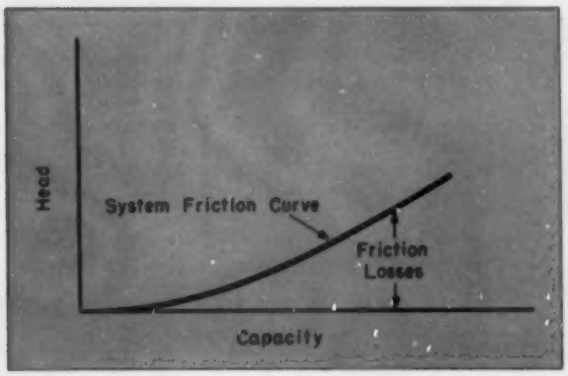
$$h_v = V^2 \div 2g$$

where: h is the velocity head in feet of water; V is the mean velocity in feet per second; and g is the accelleration due to gravity.

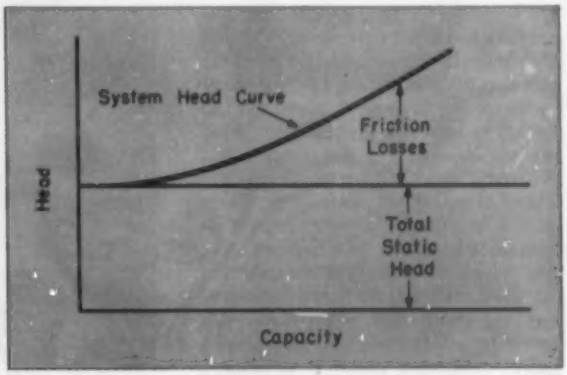
In determining the head existing in a pipe at any point, it is necessary to add the velocity head to the pressure gage reading. The pressure gage can indicate only the pressure energy while the actual head is the sum of the kinetic (velocity) and potential (pressure) energies.

The friction head loss in a system of pipes, valves, and fittings varies as a function (roughly of the square) of the capacity flow through the system. The relation between capacity and friction head loss through the system can be graphically plotted for the ready solution of pumping problems. The resulting curve is called the system friction curve and is shown below.

The determinations of friction losses are at best, rough approximations, as the exact roughness factor of any given pipe installation is not known. Because the friction loss will increase as the pipe deteriorates with age, it is usual to base the friction loss on constants that have been found from the average of pipe 10 or 15 years old. This may allow for friction losses greater than those found when pipe is new and



Typical friction head curve shows that friction head loss varies roughly as square of the capacity flow.



Using friction head losses, differences in pressures and static heads of systems can be shown graphically.

therefore, the pump is generally designed for excess head and delivers over-capacity when installed.

Using friction head losses, differences in pressures and static heads of system can be shown graphically. A curve showing the relationship between capacity and the resulting head occurring in a system is called the system-head curve. For those systems where the static heads or differences in pressures may fluctuate, it is possible to construct curves based on the minimum and maximum static heads or pressure differentials. Superimposing system-head curves on a pump head-capacity curve permits predicting the capacity that the pump will be able to deliver through the system under the varying conditions that will occur.

Total Suction Head

The total suction head is the static suction head above the pump centerline minus the friction head losses—including entrance loss—in the suction piping for the capacity being considered, plus any pressure (a vacuum is a negative pressure) existing in the suction supply.

One of the three most common suction supply and pump relationships involve a supply in a tank under a pressure other than atmospheric and include all the components of suction head as they relate to the system.

The second is a very common installation with a suction supply under atmospheric pressure located above the pump centerline.

The third is most common installation for pumps handling water and involves a supply located below the pump centerline. It is optional whether the suction head is expressed as a negative suction head or in positive values as a suction lift. A gage attached to the pump suction flange corrected to the pump centerline will register a vacuum or negative pressure. To find the suction head it is necessary to add algebraically the velocity head to this negative pressure or, if desired to work in terms of vacuum, the velocity head is subtracted from the vacuum to get the suction lift.

Since most centrifugal pump troubles occur on the suction side of the pump, it is very important that inquiries for new pumps give the vendors complete information on the suction conditions, including any variations that will be encountered in operation. Complex problems sometimes make it necessary to show the variation in total suction head graphically—superimposed on the suction head limitations of the pump in question—in order to see if the pump is suitable.

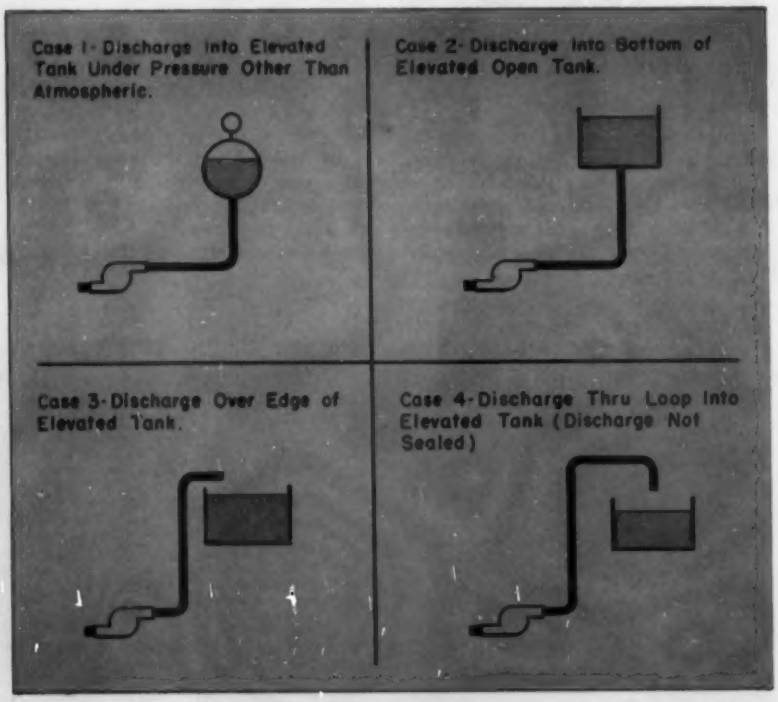
Net Positive Suction Head

In pumping liquids, the pressure at any point in the suction line must not be reduced below the vapor pressure of the liquid. The available energy that can be utilized to get the liquid through the suction piping and suction waterway of the pump into the impeller is therefore the total suction head less the vapor pressure of the liquid at the pumping temperatures. The available head as measured at the suction opening of the pump has been named "net positive suction head" and is commonly abbreviated NPSH.

A pump operating on a suction lift will handle up to a certain maximum capacity of cold water without cavitation occurring. Under these conditions, the NPSH or amount of energy available at the suction nozzle of the pump is the atmospheric pressure minus the sum of the suction lift and the vapor pressure of the water. To handle this capacity with any other liquid, the energy that must be available at the suction nozzle is calculated the same way. In the case of a liquid at its boiling point, this energy has to exist entirely as a positive head. If the liquid is below its boiling point, the suction head required is reduced by the difference between the pressure existing in the liquid and the vapor pressure corresponding to the temperature.

It is necessary to differentiate between available NPSH and required NPSH. The former represents a characteristic of the system in which a centrifugal pump works and is the difference between the existing absolute suction head and the vapor pressure at prevailing temperature. The required NPSH is a function of the pump design and represents the minimum required margin between suction head and vapor pressure.

The importance of advising the manufacturer of the actual suction conditions for a centrifugal pump at the time of its purchase cannot be over-emphasized. A pump will be unable to meet its design capacity conditions unless the suction head can provide enough energy to get the liquid into the pump. If a cold, non-volatile liquid is to be handled, it is necessary to know whether there is head on the suction or whether the pump will handle a suction lift and if the latter, what will be the maximum lift. In the event that the liquid is hot


Case 1- Discharge Into Elevated Tank Under Pressure Other Than Atmospheric.
Case 2- Discharge Into Bottom of Elevated Open Tank.
Case 3- Discharge Over Edge of Elevated Tank.
Case 4- Discharge Thru Loop Into Elevated Tank (Discharge Not Sealed)

Four typical pump discharges. Total head for each is found by adding algebraically the static heads, all friction losses, and terminal pressures.

or under a pressure corresponding to or near to its vapor pressure, the pump must be installed with head on suction and the available submergence must be made known. For liquids other than water, information on the pumping temperature and vapor pressure is also necessary. Any expected or probable variations in the suction conditions—from maximum to minimum—should also be specified.

Total Discharge Head

The discharge head, which determines the design conditions for a pump, should be stated with the understanding that it is generally composed of static elevation (or pressure) and friction losses in the discharge piping. Any variations in the static head must be known in order to determine the maximum and the minimum head against which the pump is to operate. Specifying an excessive total head has actually the same effect as specifying excessive capacity. Since a centrifugal pump will always operate at the intersection of its head-capacity curve and of the system-head curve, a pump which develops an excess head will, unless artificially throttled, deliver excess capacity, as its curve intersects the system-head curve at a higher rate of flow.

By breaking up the discharge head into static and friction head, it is readily seen whether the friction losses are excessive. If the piping, for instance, is too small, the required pump and its driver will be more expensive than necessary and the cost of operation greater than if the proper size pipe had been used.

In systems where there is a variation in some element of the discharge head, it is generally advantageous to establish the discharge head at various capacities and prepare a graph showing the variation with capacity. Combined with the suction head, the resulting chart indicates the system-head.

When the total cost involved is high and justifies an extremely detailed analysis, it is possible to determine the most economic size of pipe by plotting the sum of the amortization of initial pump driver and piping cost plus operating cost versus pipe sizes to be used.

Determining Total Head

The total head of a centrifugal pump is the energy imparted to the liquid by the pump. It is the difference between the discharge head and the suction head. Thus, if a suction lift is a negative suction head, the total head is the algebraic sum of the discharge head and the suction lift. If the discharge head and the suction head are not determined independently, the total head can be calculated by determining the algebraic sum of (1) the static head from supply level to discharge level, (2) all friction losses for the capacity being considered, (3) the entrance and exit losses, (4) the terminal pressure minus the suction supply pressure. For complex systems involving both vacuums and pressures, it is often easier to convert the vacuums and pressures into absolute pressure values expressed in feet of the liquid being handled in the system.

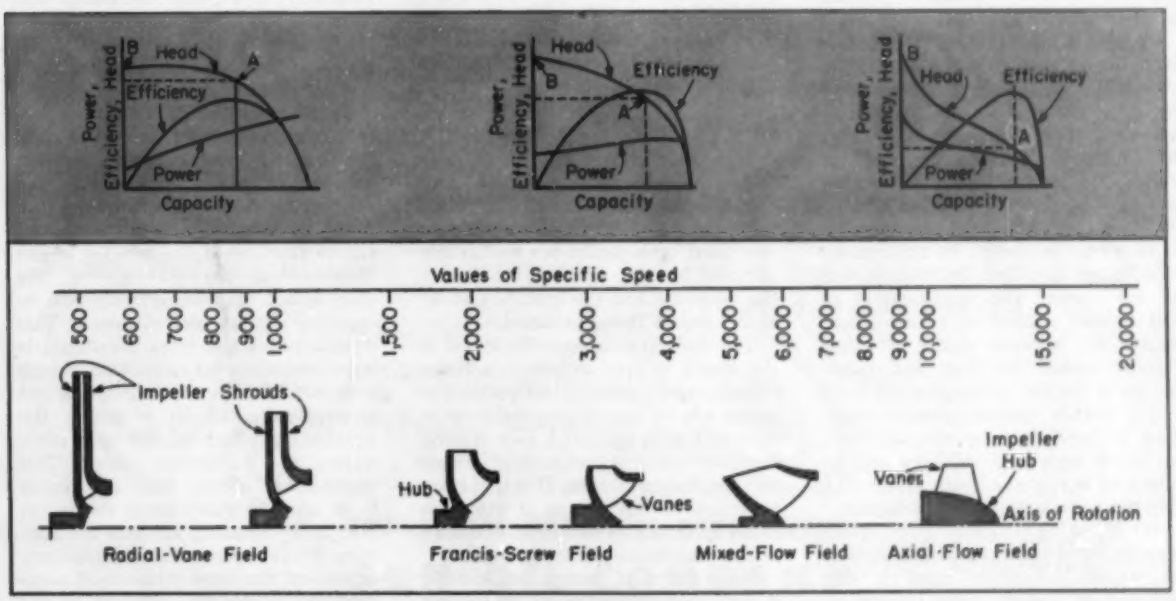
Pump Characteristics

The interrelations of capacity, head, power, and efficiency are called the characteristics of the pump. These interrelations are best illustrated graphically and are called the pump's "characteristic curves". It is usual to plot the head, power, and efficiency against capacity at a constant speed. It is also possible, for special problems, to plot three components against a fourth component. When variable speed drivers are used, a fifth component, the pump speed expressed in rpm is involved. Where suction conditions may be critical, the limit of suction lift vs. capacity or required NPSH vs. capacity is often shown. In design or application studies many other relationships may be indicated on the same graph.

The curve showing the relation between capacity and total head is called the head-capacity curve.

The curve showing the relation between capacity and power is the power-capacity curve but is generally called the power curve or the brake-horsepower curve.

The curve showing the relation between capacity and efficiency is



Profile of several pump impeller designs ranging from the low-specific-speed radial flow on the left to a high-specific speed propeller design on the right, placed according to where each design fits on the specific-speed scale.

the efficiency-capacity curve but is usually called the efficiency curve.

The pump characteristics are generally given for capacity range from zero to the normal maximum operating capacity and with scales for head, efficiency, and power all having the same zero line. In some cases, to permit clearer presentation, the head, efficiency, and power scales are selected so that their zero lines do not coincide; or critical sections of these scales may be enlarged, in which case the full range of the curves cannot appear.

Classifying Pump Curves

Pump-head capacity curves are often classified according to their shapes. Terminology in use is:

(a) Rising characteristic—or, more correctly, rising head-capacity characteristic; meaning a curve in which the head rises continuously as the capacity is decreased.

(b) Drooping characteristic—a shortened form of the true name of drooping head-capacity characteristic; covering cases in which the head-capacity developed at shut-off is less than that developed at some capacities. (This is also known as a looping curve.)

(c) Steep characteristic—referring to a rising head-capacity characteristic in which there is a large increase in head between that developed at design capacity and that developed at shut-off. (It is sometimes applied to a limited portion of the curve; for example, a pump may be said to have a steep characteristic between 100 and 50 percent of the design capacity.)

(d) Flat characteristic—referring to a head-capacity characteristic in which the head varies slightly with capacity, from shut-off to design capacity. (The capacity might be, in addition, either drooping or rising. All drooping curves have a portion in which the head developed is approximately constant for a range in capacity. In such cases that range is called the flat portion of the curve. The qualification of flat is also applied at times to indicate the general shape of other curves—either for their full range or for a limited range.)

(e) Stable characteristic—referring to head-capacity characteristic in which only one capacity can be obtained at any one head. (Basically, this has to be a rising characteristic.)

(f) Unstable characteristic—referring to head-capacity characteristic in which the same head is developed at two or more capacities. (The successful application of any pump is dependent as much upon the characteristic of the system on which it is operated as upon the head-capacity characteristic. Most pumping systems permit the use of pumps with moderately unstable characteristics.)

The power-capacity curves have also been classified according to their shapes. A pump characteristic with a power curve which flattens out and then decreases as the capacity increases beyond the maximum efficiency point, is called a non-overloading curve. When the power curve continues to increase with an increase in capacity, the pump is said to have an overloading curve. The shape of the power curves varies with the specific speed type. As a result, the curve may be one which has a very low value at shut-off, or it may be one which has a high shut-off power—or it may have values lying between these two points.

While pumps with non-overloading power curves are advantageous because the driver is not overloaded under any operating condition, they are not available in all specific speed types of pumps. The actual range in operating conditions to be met by a pump and its driver determines the range in power requirements. The driver size should be selected to correspond to the power needed.

Rating curves and rating charts, originally intended for use only by pump salesmen, are now being more commonly used in bulletins and other sales literature. They show, in a condensed form, the possible range of applications of given pumps, either for a range in speed or for a range in impeller diameters for these pumps.

Specific Speed

The basic characteristics of centrifugal pumps vary with the specific speed type and the individual pump design. The characteristics produced by a pump can be further affected by the suction conditions, the viscosity, and the specific gravity of the liquid being pumped.

The definition of specific speed is the speed in rpm at which a theoretical and geometrically similar pump would run if proportioned to deliver 1 gpm against 1 foot of total head operating at optimum efficiency and service conditions. It is therefore an index for all pumps of this type using the capacity and head obtained at the maximum efficiency point.

The normal range in specific speeds encountered in single suction impeller designs is from 500 to 15,000 with approximate impeller profiles previously indicated. Basically, the lower the specific speed type, the higher the head per stage that can be developed by the pump.

These charts are intended to indicate only the maximum rotative speed for which experience has proven that a centrifugal pump can be designed with assurance of a reasonable and proper operation for the combination of operating conditions actually encountered.

Pump Design Variations

Some variations in the shape of the curves can be obtained in the design of the impeller and casing waterways, but the variations that can be made without adversely affecting the efficiency are relatively small in most cases.

The impeller cannot impart energy to the liquid until the liquid is in the impeller, between the vanes. The energy necessary to overcome the friction losses up to the suction vane ends of the impeller and the energy necessary to create the velocity required at this point has to come from some outside source. Furthermore, sufficient additional energy must be available in excess of these and other requirements so the absolute pressure at all points is above the vapor pressure of the liquid to prevent its flashing into vapor in the pump.

Cavitation

If there is not sufficient available NPSH to permit a pump to develop its normal characteristics, cavitation will result, and the pump will "work in the break". In this manner, the characteristics of a centrifugal pump will vary with the available NPSH as indicated.

In handling liquids containing dissolved gases, the pressure at or near the suction vanes of the impeller may be reduced sufficiently so the dissolved gases are liberated and the pump is actually handling a gas and liquid mixture. If the amount of gas liberated is not excessive, the only effect may be a reduction in capacity output and efficiency. This separation of gas from the liquid is often mistaken for cavitation, which it is not. If both cavitation and gas separation occur in a pump, the cushioning effect of the gas often quiets the cavitation noise. This cushioning effect has sometimes been used to quiet noisy cavitation pumps by bleeding air into the suction. While it serves as a temporary expedient, the most economical solution should be replacement of the impeller by a design suitable for the suction conditions.

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New Multimillion-Dollar Plant Producing Better General Lubricants at Moderate Prices

They can be used for lubrication of plain bearings, antifriction bearings, linkages, slides, cams and gears; in gear boxes, hydraulic systems, circulating systems, industrial diesel engines, compressors.

They can be used for longer periods because they resist oxidation, prevent rusting and corrosion.

They can be applied by every method used in the general lubrication of industrial machinery.

They have low carbon content In compressors, for instance, any carbon that does form is soft and fluffy, is easily blown off, does not build up.

For technical bulletins, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. IP-2.

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PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

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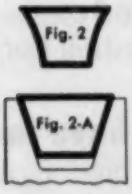
Why V-Belts with CONCAVE SIDES Last Longer!

(U.S. PAT. NO. 1815899)

Prove this yourself!

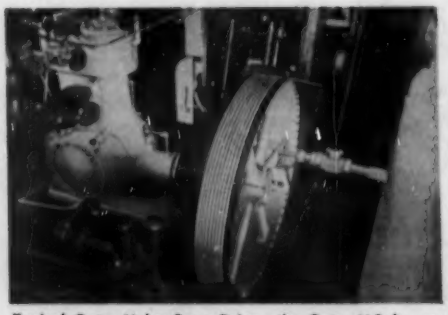
Take any *straight-sided* V-Belt (Fig. 1). Bend it—as it bends in going around a pulley. The sides will at once *bulge out* (Fig. 1-A). Clearly, those bulging sides will press *unevenly* against the V-pulley—and this causes *extra wear* at the points shown by the arrows (Fig. 1-A).

Now bend a Gates Vulco Rope with CONCAVE SIDES (Fig. 2)



Instead of *bulging*, the precisely engineered CONCAVE SIDES merely *fill out* to *fit exactly* in the sheave groove (Fig. 2-A). The sides press *evenly* against the V-pulley. All wear is distributed *uniformly* across the *full width* of the Gates Vulco Rope—and this means *longer* belt life and *lower belt costs* for you!

When you buy V-Belts, be sure to get the V-Belt with the CONCAVE Sides—the Gates Vulco Rope!



Typical Gates Vulco Rope Drive—the Gates V-Belts are built with Concave Sides to insure longer belt wear.

Gates VULCO ROPE DRIVES

REG. U. S. PAT. OFF.

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

THE GATES RUBBER COMPANY
DENVER, U.S.A.

CS-541

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Sizing Return Lines

R. S. POLLARD, Manager, Steam Trap Sales
Yarnall-Waring Company

IN ANY STEAM TRAP piping system, both individual discharge pipes and return mains must be sufficiently large to carry away all condensate and flash steam without causing excessive back pressure. This is particularly important when steam traps are working in the higher pressure range because a considerable amount of flash steam will be formed. Unless the piping system is adequate, this large flash steam volume will choke up discharge pipes or sections of the return main and create a high back pressure with consequent reduction in trap capacity and effectiveness.

Fig. 1 presents one convenient method of establishing pipe sizes for return systems. This chart has three sets of crossing lines—factor of safety, back pressure, and equivalent length of pipe in feet—which are correlated to permit direct determination of pipe sizes for specific operating conditions. The factors of safety are typical data published by trap manufacturers. Back pressure is the pressure in the return system (including an allowance of 0.5 psi per ft for the vertical height of the discharge main above the trap) in percent of inlet pressure at the trap. Equivalent length of pipe is the actual length of discharge pipe in feet from trap to return main or condensate collector plus the pipe length equivalent of fittings as shown in Table 1.

Use of the Chart

Use of the chart is demonstrated by the dotted line on Fig. 1. This example illustrates the procedure for determining the size of the discharge line for a ½ in. trap with a net orifice area of 0.013 sq in. serving a cooking kettle. Inlet pressure at the trap is 150 psig, and pressure in the return system is 10 psig. The discharge pipe is 15 ft long, contains one elbow and one tee, and enters the return header 10 ft vertically above trap.

When solving this problem, reference to data published by trap manufacturers indicates a factor of safety of 2 is recommended for cooking kettles. Back pressure at the trap is established by adding 5 psig (0.5 psi per ft of 10 ft height) to the return system pressure of 10 psig. The resulting value of 15 psig equals 10 percent of the initial 150 psig pressure. Then, assuming the discharge line is the full size of the tapped connection on the trap, equivalent length of pipe is determined by adding 1.6 ft (½ in. elbow), 3.5 ft (½ in. tee), and 15 ft (pipe length) together to obtain a 20.1 ft equivalent length. (See Table 1).

With these trial data established, enter the chart from left at the orifice area of 0.013 sq. in. and proceed horizontally to the factor of safety line marked 2. From this intersection, move vertically to the 10 percent back pressure line, and continue horizontally to the right to the 20 ft equivalent length of pipe line. Then drop down vertically to read size of discharge pipe, which in this example is ½ in. as originally assumed. If a size other than that estimated is indicated, the equivalent length should be re-evaluated and the final size checked.

While the chart primarily facilitates determination of the size of discharge lines from individual traps, it also can be used for selecting return mains. One method is to add together the areas of each discharge pipe to obtain the minimum area of the main return line. When using this procedure, the chart

TABLE 1 — EQUIVALENT PIPE LENGTHS FOR STANDARD FITTINGS

Pipe Size I.P.S.	Area Sq In.	Equivalent Length of Pipe in Feet				
		Elbow	Tee	Check Valve*	Gate Valve*	Globe Valve*
½	.304	1.6	3.5	4.0	.35	17
¾	.533	2.2	4.5	5.5	.50	21
1	.864	2.8	5.8	7.0	.60	29
1¼	1.50	3.7	8.0	9.0	.80	38
1½	2.04	4.5	9.0	11.5	.95	45
2	3.36	5.5	12.0	14.0	1.2	56
2½	4.79	6.5	14.0	16.5	1.4	65
3	7.39	8.0	17.5	20.0	1.7	80
3½	9.89	9.5	19.0	23.0	2.0	100
4	12.73	11.5	22.0	26.0	2.4	120
5	20.01	14.0	28.0	33.0	2.9	140
6	28.89	16.0	34.0	40.0	3.5	170
8	51.16	21.0	44.0	53.0	4.6	230

*With valve in open position.

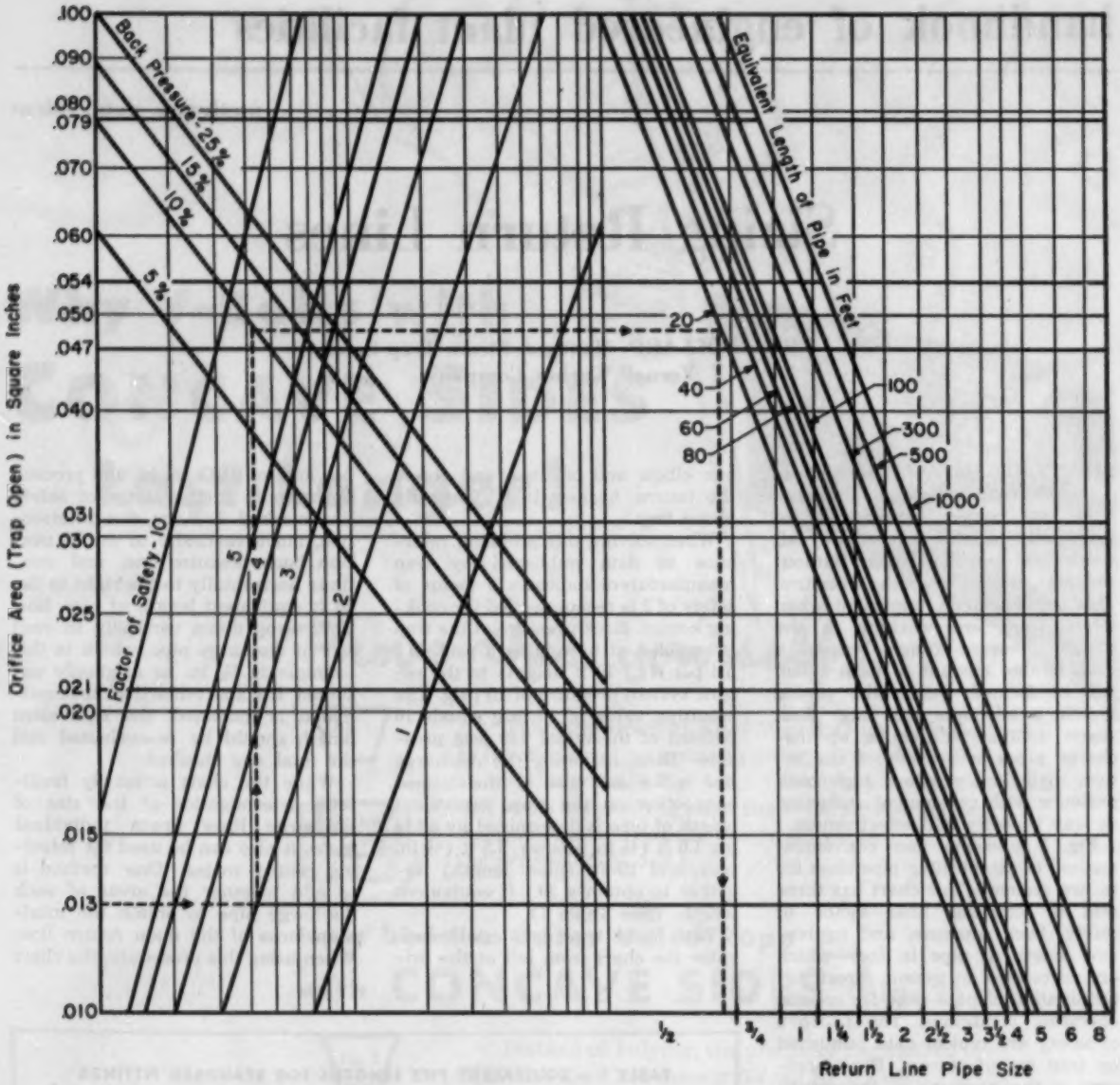

Fig. 1 — Chart for determining the sizes of individual discharge pipes and return mains for steam trap piping systems.

should be interpolated to establish the net area needed by each trap. For example, the dotted line on Fig. 1 shows that the actual requirement is approximately 90 percent of the 0.304 sq in. internal area of a ½ in. pipe or 0.274 sq in. net. This value should be used when calculating total area.

Where systems contain a multiple number of traps which have analogous values for the three chart variables, rapid checks on return line size can be obtained by totaling the orifice areas and entering the graph at this composite value. Even if the summation is beyond the range of Fig. 1, this method can be applied by dividing the total orifice area by some numerical value that will provide a net figure within the chart range. For example, assume the total orifice area of all traps in a system is 0.162 sq in., which is beyond the range of the chart. Dividing this figure by three would give an area of 0.054 sq in. and would provide a point for entering the graph.

After proceeding through the necessary steps, assume a return line size midway in the 2 in. zone is indicated. This would be interpreted to mean that all of the area of a 1½ in. pipe plus half the additional area provided by a 2 in. pipe is required. Then reference to Table 1 will show a return line area of 2.70 sq in. is required for 1/3 of the total orifice area for all of the traps involved. Multiplying this figure by three (the same figure by which the area was divided above) produces a total area requirement of 8.10 sq in., which is between a 3 in. and a 3½ in. diameter pipe. Thus, a 3½ in. diameter pipe would be used to allow some margin of safety.

At many plants the length of the return lines is appreciable. This may dictate the use of graduated sizes for various sections of the main to obtain an economical installation. The chart can be used to greatly facilitate calculations for such systems and to insure that the pipes are sufficiently large to remove all condensate and flash steam.

CHIEF ENGINEER WILLIAM NOTE inspects the original Leslie Temperature Pilot taken from heater for its first overhaul. Leslie Representatives Frank Riggio (*left*) and Bob Gentner (*right*) look on.

DEWITT O. HESSLER, Laundry's President, joins Chief Note in examination of the original Leslie Pilot before reinstallation.

HOW SHOULD A 21-YEAR-OLD BEHAVE?

Temperature Pilot leads flawless life for 21 years prior to its recent, initial overhaul

A 21-year-old Leslie Temperature Control Pilot had its "coming-out-party" recently at the Hessler Laundry, Paterson, N. J. The very first one of its kind ever made, it was installed at the Hessler plant back in 1933 by the firm's chief engineer, Bill Note—who also ordered the pilot's first overhaul in 21 years of continuous service.

The pilot was designed to control constant process temperature over extended periods without necessity for recalibration or replacement of thermal elements. The Hessler field test worked out so well that the pilot was left untouched after its initial setting, for 21 years.

Periodic inspections showed the pilot was doing the job without appreciable wear or need for *any* attention. This year, it was removed from the heater for a complete examination and after a quick clean-up, it was put right back into service.

Top performance suggests other applications

The outstanding behavior of this first pilot is being repeated today by Leslie Pilots in hundreds of other applications in all industries. The wide adjustable ranges (32°-400°F and 300°-600°F) make the pilots adaptable to most operating conditions. The fast-responding bi-metallic element responds to changes as small as ¼°F.

CHIEF NOTE REINSTALLS PILOT after *no-cost* overhaul. Parts showed no appreciable wear or corrosion after 21 years of continuous hot water heater service.

Send for Technical Data Sheet 464-14 describing Leslie Temperature Pilots and Controllers.

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TOPS IN QUALITY PRESSURE LEVEL AND TEMPERATURE CONTROLS

Since 1900

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spot news

. . . what's happening in U. S. industrial plants

Snow Melting Coils Embedded Under Hanger Door Tracks

To prevent winter's snow and freezing rain from interfering with normal operating routine, Grumman Aircraft Engineering Company's Peconic River Plant in Long Island is embedding snow melting coils of wrought iron pipe manufactured by A. M. Byers Company in the concrete apron of tracks serving sliding doors of new hangers in the plant area. Heated water mixed with antifreeze will be circulated through the coils to warm the concrete apron.

Because the heated surface eliminates ice and melts snow as it falls, the big doors are expected to slide easily on their snow-free tracks to assure year-around access to the buildings.

Filtration of Grinding Oil Reduces Costs

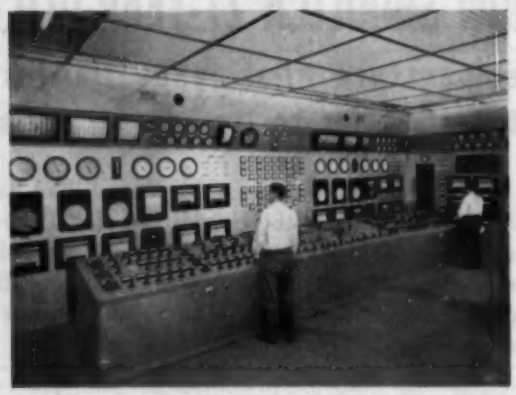
Although the filtration of fluids can and should be a highly important factor in almost every industry, it is surprising how little is known or practiced in many plants. Millions of dollars worth of fluids which are still being dumped as waste by industrial firms can be reclaimed by modern filtration methods.

An ideal opportunity to compare operations with and without the benefits of oil filtration presented itself when a new grinding department was set up in the Precision Forging Div. of the Utica Drop Forge and Tool Corp. The company had started production of precision forged jet engine blades in Nimonic 80 stainless steel. A pilot run was set up before complete production facilities could be installed. Therefore two form grinders with insufficient filtering equipment were set up for temporary production until eight additional grinders and an adequate central oil filtration system could be delivered and installed.

On this basis, the oil used by the two grinders became heavily contaminated after brief use. The contaminated oil on the wheel surfaces burned many parts causing a high percentage of rejects. Two diamond dressers are used in each grinder to maintain the profile on the abrasive wheels. Largely because of contamination eight sets of diamonds had to be used on each machine every eight hours for a cost of $496.

After the grinding department was completely equipped for standard production with a filtration system made up of three U. S. Hoffman pressure filters Model I-80-S, the cost for diamonds fell to $62 for six machines, which was the average number in operation each day.

Six thousand gallons of dirty oil which had been accumulated in storage during non-filtration operations was reclaimed by putting it through the system and restoring it to its original condition. This oil is now used to make up gradual losses in the system and represents a saving of $3600.



Wider Use is Predicted

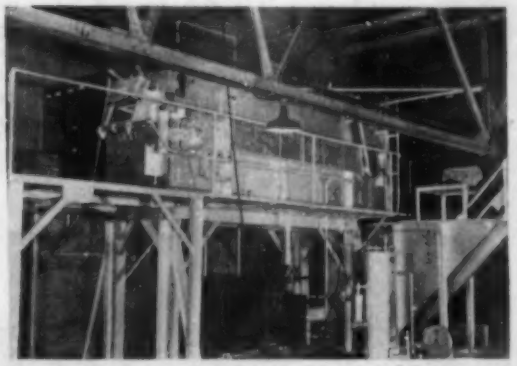
Power demands made upon the public utilities have caused widespread expansion and modernization of existing facilities. In a year-end report, Minneapolis-Honeywell forecasts that more and more automatic indicating, recording, and control instruments like those in this panel will be harnessed in 1954 to oversee such operating factors as conductivity, frequency, and electrical power output as well as boiler room conditions.

Use of Hanging Scale Saves Time and Work

Weighing 209 fire extinguishers once a week to make sure they contain the proper volume of CO_2 formerly was a three-day job at Food Machinery and Chemical Corporation's Ordnance Div.

The job was done previously by driving a fork lift truck, loaded with a pallet and large cumbersome scale, around to each extinguisher station to make the weekly

volume check. The same job is now accomplished with a lightweight hanging scale. The small hand scale is hung from the extinguisher bracket, and the extinguisher is attached to the scale for weighing. Besides saving 2½ working days, the valuable fork-lift truck is released for other work.



Furnace is Mounted On Scaffolding

Faced with the problem of positioning a Lindberg electric conveyor atmosphere hardening furnace, Auto Specialties Manufacturing Co. built an inexpensive scaffold that could be easily dismantled. Since the plant is located on sandy soil just off the shore line of Lake Michigan, water would have been encountered when sinking the quench tank.

Large containers holding the work to be treated are hoisted to the loading platform by a lift truck where the operator shovels it into the furnace. After treatment, work drops from the conveyor belt into the quench tank where a flight conveyor drops it into a steel chute leading to tempering baskets. This solution also lends itself to space savings since atmosphere generators, control panels, and other equipment can be placed underneath.

Automation Is Necessary For Industrial Progress

"If industry is to continue to make the type of progress that has raised our standard of living so much over the past two or three decades, it must plan on more and more automation in production lines," G. H. Gustat, Eastman Kodak Company, told members of The American Society of Mechanical Engineers attending their annual convention in New York.

He warned that lower costs and greater production volumes will depend on "how good and timely the judgment is that fosters the changes to automation.

"Top management personnel must continue to have the faith to invest, often huge sums of money, in new and improved equipment that will produce more and more wealth which in turn raises our standard of living and provides continuing employment for greater numbers of people."

He pointed out that the "current shortage" of young

RODA — High grade gas, by-product, steam and household stoker coal from Wise County, Virginia, on the Interstate Railroad.

DENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

GLENBROOK — The Premium Kentucky High Splint unmatched for domestic use. Produced in Harlan County, Kentucky, on the L. & N. Railroad.

COKE — Roda and Stonega from Wise County, Va.

CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

HAMPTON COAL — High volatile domestic, steam and by-product coal from Boone and Logan Counties, W. Va., on the Chesapeake & Ohio Ry.

CROZER — Genuine Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railway.

LYNCO — High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Virginian Ry.

ANTHRACITE

Hazel Brook—*Premium Lehigh*
Raven Run—*Premium Mahanoy*
Cross Creek—*First Grade Lehigh*

Our engineering service, available upon application, and long and varied experience is your assurance of the Right Coal — Properly Applied.

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HOW TO ROLL BOILER TUBES

You can count on smooth, efficient rolling action, which assures firm seating of the tube from precision-made Wilson Tube Expanders. They provide perfectly rolled joints, reduce time wasting re-rolling and re-inspection.

Wilson Model 38 Tube Expander— Popular, parallel, expansion flaring and rolling tool for high pressure boiler tubes, superheaters, economizers and marine steam generators. They do both rolling and flaring in a single operation . . . are available for tubes 1" OD to 4½" OD with various rolled lengths for tube sheets a half inch and up in thickness. Write for Bulletin 380A.

Wilson Accessories — Various boiler-maker accessories are in stock such as right angle worm drives, gear trains, extensions, universal joints in standard size squares, etc. Look to Wilson for a complete line of modern expander tools.

Wilson Tube Cleaners make short work of the toughest deposits. Driven by air, water, steam or electricity, these high speed tube cleaners can be furnished in straight or curved, ferrous or non-ferrous from ⅜" to largest ever cleaned. Write for Bulletin 47A.

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spot news

—Starts on page 86

engineers is creating a problem for both supervision and top management because it is this type of labor that helps to design, install, and maintain automatic equipment, but that it must not be construed that engineers alone will do the job. Rather, automation emphasizes the importance of supervision, technical men, operators, and staff department personnel work together as a team, to design, install, and operate the equipment.

Coal Rides Cross-Country on Rubber Belt

One of the world's longest permanent rubber conveyor belt systems transports 800 tons of coal per hour over a four and one half mile twisting, up and down hill course from strip mine, to coal storage area on the bank of the Muskingum River. To reach its destination, the beltroad bridges county roads, spans a state highway, and crosses the 500-ft wide Muskingum.

The entire conveyor system is composed of 14 flights, or sections, of rubber conveyor belting, ranging in length from 500 to 2964 ft pulley to pulley distance. The belts, all products of B. F. Goodrich, are 36 in. wide and travel at a speed of 600 ft per min. Highest incline angle is 12 degrees; greatest decline is 12 degrees. Transfer points located where one belt flight ends and another begins automatically cause the coal to discharge from one belt to another.

Coal carried by the conveyor system serves as the source of fuel for The Ohio Power Company's new 400,000 kw Muskingum River Plant.

Corrosion Control Method Patent Is Upheld

A patent covering corrosion control methods now used to protect municipal and industrial water systems of about 600 cities and 1300 factories and plants has been upheld in a U. S. appeals court.

Owned by Hall Laboratories, Inc., Pittsburgh en-

Less dust for St. Louis housewives...

Boiler No. 5 Stack and Precipitator left—before precipitator start-up right—precipitator in operation (boiler load 200,000#/hr.)

Anheuser-Busch leads the way with AEROTEC Electrical Precipitators

The brewers of famous Budweiser Beer know the importance and value of good public relations. Not content with just meeting local requirements for dust control, the Company sets the pace for air-pollution control in St. Louis.

Together with an existing mechanical collector, the first of five Aerotec Electrical Precipitators at Anheuser-Busch *is collecting 2000 lbs. of dust every 60 minutes from a single stack.*

The remaining four electrical precipitators are about to be placed in service, and dust emission will be less than one fourth of the maximum allowable under the requirements of St. Louis' dust ordinance.

Reasons for Aerotec's higher collecting efficiency are:

- Pocket-type collecting electrodes prevent precipitated dust from re-entering gas stream.
- Exclusive flat high voltage plate presents a field of uniform maximum intensity for most effective precipitation.

For other advantages of Aerotec Electrical Precipitators write or call our project engineers—Thermix Corporation.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario

Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.

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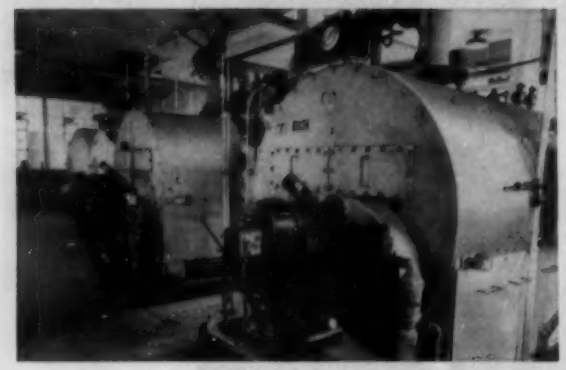
How 2 Dutton EconoTHERMS CAN CUT YEARLY STEAM COSTS



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GAS OR OIL FIRED • AUTOMATIC OPERATION
NO COSTLY CHIMNEY OR FOUNDATION
ONE "PACKAGE"—FACTORY PRE-TESTED

DO YOUR DAILY and seasonal steam loads vary widely? Many owners find that *two or more* Dutton EconoTherm Boilers give big advantages over a single larger unit — especially in *lower total steam costs!*

WITH TWO OR MORE EconoTherms, you can meet varying steam demands fast — and at *peak fuel efficiency.* Yet you save fuel each day and all year by operating just *one* unit during warmer weather, "off hours", nights, week-ends and holidays.

MULTIPLE UNITS give *extra* protection from plant shutdowns . . . and as your plant grows, it's easy to add another "packaged" EconoTherm. Because steam costs depend mostly on fuel and labor costs, *every EconoTherm feature* is designed to keep costs low!

CALL YOUR DUTTON REPRESENTATIVE — he'll carefully analyze your particular needs and offer cost-cutting suggestions.

CHECK FIRST with

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Division Hopman-Dutton Company
KALAMAZOO, MICHIGAN
Boiler Builders Since 1880
Four Types — Sizes from 5 to 300 H.P.
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spot news

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gineering consultants in municipal and industrial water problems, the patent involves adding small amounts of metaphosphate, commonly sold under the trade mark Calgon, to the water to form a protective film on the metal.

The patent involved was granted to Owen Rice and George B. Hatch, with Hall Laboratories, Inc., as assignee. Rice is vice president and Dr. Hatch a research chemist of Calgon, Inc., Hall Laboratories affiliate. Both firms are subsidiaries of Hagan Corp.

New Boiler Replaces Low Pressure Unit

An additional 50,000 lb of steam per hr is now available following the installation of a new steam boiler at the Fort Frances, Ontario, plant of the Minnesota and Ontario Paper Co. Expected to produce 100,000 lb of steam per hr, the Foster-Wheeler SA boiler replaces a low pressure unit of 50,000 lb per hr capacity.

Although the boiler is designed to use Canadian lignite, it will be adapted to burn bark and other wood refuse.

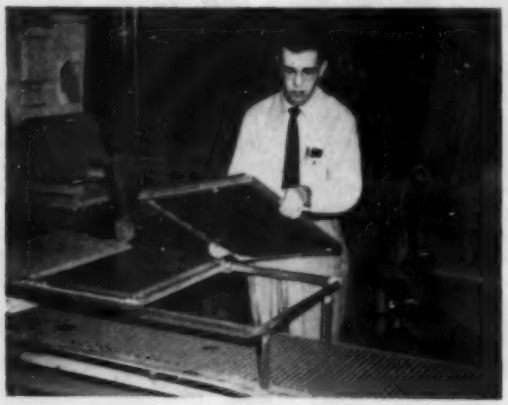
The boiler is part of the company's long-range modernization program that has cost more than $40 million since 1945.

Narrow Aisles Add To Storage Space

Aisles nearly one-third narrower than had been considered possible have solved a storage problem for the Lamson & Sessions Co., which recently converted a manufacturing plant to storage and warehouse facilities.

First plans called for nine-foot aisles, considered the

narrowest possible for effective handling of palletized goods. The revised layout, made possible by using a Transveyor stacker electric fork lift truck, manufactured by the Automatic Transportation Co. calls for aisles only six and one-half feet wide. The extra space was added to the stock area, giving the warehouse more storage room, without increasing its size.



Radiant Heating Panels Assure Uniform Temperature

Radiant heating panels designed and constructed specifically for industrial application offer an improved concept in infrared heating. Long-wave-length black-body radiation from an area source assures temperature uniformity over large areas and maximum heat absorption, regardless of surface texture or color of material being treated.

They are suitable for operation at temperatures as high as 350 C and range in watt densities from 2.6 to more than 9 watts per sq in.

The heating element, uni-directional and backed with an aluminized steel reflector, operates without additional insulation, minimizing installation and maintenance costs. The large radiating area makes possible a high power output while element temperatures remain at a relatively low level, reducing the fire hazard.

Heat generating elements are sheets of Pyrex brand heat resistant glass with an electrically conductive film fired onto the back surface.

The heating panels are made by Corning Glass Works, Corning, N. Y.

Wet Blasting Reduces Cleaning Time

With scores of parts in plant equipment requiring periodic cleaning, plant engineers have had reason to look for mechanical methods of cleaning. Parts like oil burners for furnaces, and pistons, valves, and rods for plant engines need to be freed of carbonaceous scale, rust, and other surface contaminants to avoid plugging up. Similar contaminants must be dealt with on glass molds, dies, plastics and rubber molds.

The cleaning problem is made more difficult because many of the parts are built to close tolerances. As a general rule, manual methods have been used for this cleaning, although chemical means have been employed.

In an effort to decrease maintenance costs and speed

Both these SPECIALISTS help you operate efficiently, reduce wasteful spending

No business would attempt to operate very long without the services of an accounting specialist.

And, no liquid handling program should be started without the guidance and recommendations of a WEINMAN Centrifugal Pump Specialist.

This man knows how to reduce your pumping costs by improving pumping efficiency and capacity. He can specify the right pumps for your needs with confidence, because that is his business — because his career and his success depend upon his ability to do so.

So, if you're considering the installation of new pumps, or the improvement of your present liquid handling system, call in a specialist . . . a WEINMAN Centrifugal Pump Specialist.

Representatives in principal cities.

Built by Centrifugal Specialists
The WEINMAN Pump Mfg. Co.

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Put up to Stay up!

trouble free service for over 22 years...that's only one record for...

GRID UNIT HEATERS

That's the experience of a large midwest manufacturer. Twenty-two years of service without need for repairs prove to him that, with a GRID installation, first cost is last cost. Such service records (GRID installations made in 1929 are still operating) are the rule rather than the exception with GRID Unit Heaters because GRID was deliberately designed to be a better unit heater. To provide not only ample, comfortable heat, but to give years of service without the usual high maintenance cost generally experienced with ordinary unit heaters.

Such service records occur because GRID is completely different from other unit heaters — here's how:

GRID is an all cast unit with finned heating sections and headers tested to withstand steam pressures up to 250# P.S.I.

GRID construction uses no brazed, soldered, rolled or welded connections between condenser and headers. A specially designed threaded nipple assures a precision, leak-proof fit.

GRID construction has all similar metals in contact with steam, thus preventing electrolytic corrosion which eventually occurs in copper type unit heaters where steam passes from iron pipes into copper cores. (Write for booklet CORROSION IN UNIT HEATERS.)

GRID construction resists corrosion from fumes present in most types of industry.

GRID design incorporating low outlet temperatures, proper fan sizes and motor speeds, assures delivery of warm comfortable air in ample volume to the working level. No stratification of warm air at the ceiling to waste your fuel dollars.

These are the reasons why users of GRID Unit Heaters get 22 years and more of trouble-free service. There are units cheaper than GRID, but there is none better. You start saving money the day you install GRID Unit Heaters.

GET THE COMPLETE GRID STORY — WRITE FOR CATALOG CUH-846-A.

GRID Blast Coils are ideal for process drying — write for Catalog BC-1049.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

D. J. MURRAY MANUFACTURING CO.
MANUFACTURERS SINCE 1883 WAUSAU, WIS.

Circle 548 on Reply Card for more data

spot news

—Starts on page 88

processing, many engineers have turned to the wet blasting process, which is particularly appropriate for cleaning problems where holes, pockets, and other recesses make it difficult to reach the contaminants and remove them.

In a typical example of wet blasting at the A. Finkl & Sons Co., a Liquamatte machine manufactured by American Wheelabrator & Equipment Corp. is used to recondition oil burners for furnaces in the die shop, and oil burners for the company's boilers. The carbon-coated burners were formerly cleaned by manual scraping when they became plugged. Each of these parts is now wet blasted to virgin metal in approximately ten minutes' time with 140 mesh QZ Liquabrasive, and the parts are ready to be put back into service immediately. Many other parts receive the same treatment at a great saving in time while holding to tolerance limits required for furnace oil burners.

Valve Can be Operated With Blade Shaft in Any Position

One of the largest butterfly valves ever built for handling air is being installed in a wind tunnel at one of the government's aeronautic laboratories. To be used to control the volume, speed, and pressure of the wind to which planes are subjected in test, the valve was designed and constructed by W. S. Rockwell Co. The assembled valve, weighing 7.5 tons, has a 96-in. ID with an overall flange diameter of 108 in.

Because of its size and special manufacturing conditions, it was fabricated of steel, structural members, and forgings. The entire unit was designed to be operated with the blade shaft in any position, so that it was necessary to incorporate a heavy duty, double acting bearing in order to support the weight of the shaft and blade under any operating conditions.

The blade is actuated by a large hydraulic cylinder, 10-in. bore, 51-in. stroke, with oil at 1000 psi as the

It's a good thing for you that Mrs. MacTavish was on the school board

The plans for the new school building were all completed and were now being shown to the Board.

"And why," asked Mrs. MacTavish, "should the new building burn oil instead of coal?"

"Well," explained the architect very patiently, "oil saves labor."

"So does a stoker!" snapped Mrs. MacTavish.

"And oil is clean."

"No cleaner than coal if you use the right grade and burn it right. What's more, you can always get coal and maybe you can't get oil. Remember how the schools over at Jamestown had to shut down for weeks at a time during the war because they couldn't get oil?"

"Anything else, Mrs. MacT?"

"Indeed there is. I always save my big reason till the last. Coal's a sight cheaper."

"Oh now, Mrs. MacT., I don't think there is so much difference."

"When it comes to spending money, I don't want to think — I want to know. The Chesapeake and Ohio Railway has a combustion engineering service — absolutely free, mind you. Let's get their man to come in and give us facts — not opinions."

The C&O combustion engineer's carefully documented survey proved beyond doubt that coal would not only save several thousand dollars a year in fuel cost, but that the installation itself would be cheaper.

"There should be a Scot on every civic board," snapped Mrs. MacTavish. "We're the only people left who seem to care a hoot about the taxpayer's pocketbook."

Bring your fuel problems to C & O

As the world's largest carrier of bituminous coal, the C&O is intimately familiar with every phase of coal use. We have a large staff of experts who will gladly help you to locate the coal best suited to your needs; to help you use it most efficiently; to help get it to you promptly.

Write to:
Coal Traffic Department
Chesapeake and Ohio Railway
2110 Terminal Tower
Cleveland 1, Ohio

Chesapeake and Ohio Railway

COAL...FUEL OF THE FUTURE

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HILCO LUBE and FUEL OIL PURIFICATION

Get Rid of Dirty Oil . . .
Get Lower Operating Costs,
Longer Equipment Life

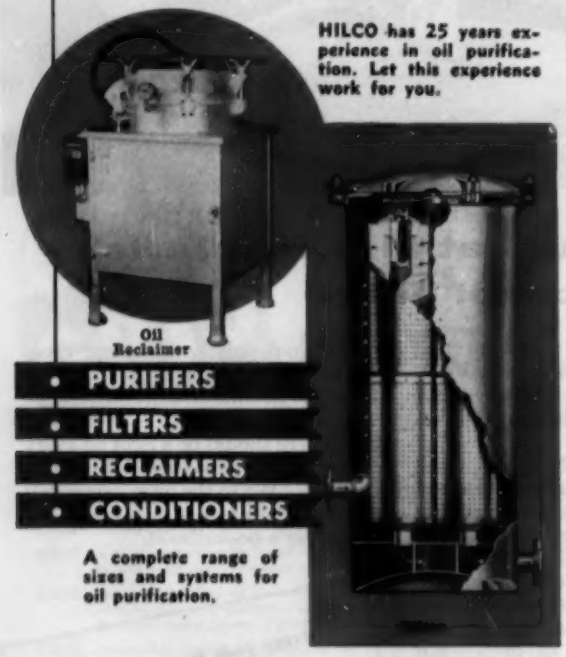
HILCO oil purification means complete oil purification! With a HILCO you get removal of sludge, acids, carbon, water and fuel dilution economically and efficiently. HILCO operation is continuous, all-electric and automatic.

Clean oil at all time reduces down time, increases production and HILCO units pay for themselves in savings.

HILCO offers a wide range of oil purification units . . . one to meet your needs. Write us about your equipment . . . and get recommendations at no obligation.

• THERE'S A HILCO FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM

HILCO has 25 years experience in oil purification. Let this experience work for you.



Oil Reclaimer

- PURIFIERS
- FILTERS
- RECLAIMERS
- CONDITIONERS

A complete range of sizes and systems for oil purification.

• WRITE FOR FREE LITERATURE ...NO OBLIGATION ON YOUR PART

THE HILLIARD Corporation
105 WEST FOURTH STREET
ELMIRA, N. Y.

In Canada:
Upton-Bradeen-James, Ltd. • 390 Bay St., Toronto
3464 Park Ave., Montreal

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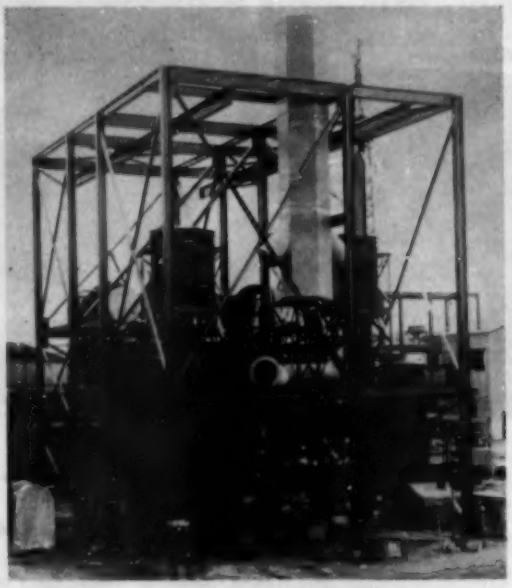
spot news

—Starts on page 86

power medium. A power unit this size is capable of developing a theoretical torque of 3,300,000 in.-lb. The valve has its own hydraulic system complete with motor, pump, accumulator, and controls.

It was designed to handle air at temperatures up to 390 F, at pressures to 15.3 psi. The maximum pressure differential across the blade in the closed position is 9.7 psi.



Stack is Designed For Acid Fumes

Constructed for hydrofluoric acid fumes, this concentrator stack is made of a special Iolyte laminate of Fiberglas and cotton. Iolyte is a chemically-resistant structural material that will not break or crack and is said to have the tensile strength of steel but weighs 1/5 as much.

The stock was made for a southern chemical plant by Schori Process Div. of Ferro-Co. Corp. Because of its size, 32 ft high and 5 ft in dia, it was fabricated in three sections and the sections joined at the site.

Couplings and Fittings Are For Grooved Aluminum Pipe

Increased production and use of aluminum pipe has brought about the need for couplings and fittings designed especially for this lighter pipe.

Aluminum Gruvagrips and fittings made by Gustin-Bacon Mfg. Co. are for grooved, light-weight, high pressure pipe systems. Available in 2, 4, 6, and 8 in. sizes, the eight inch Gruvagrip weighs less than 11½ lb complete.

These couplings automatically absorb expansion and

(Continued on page 110)

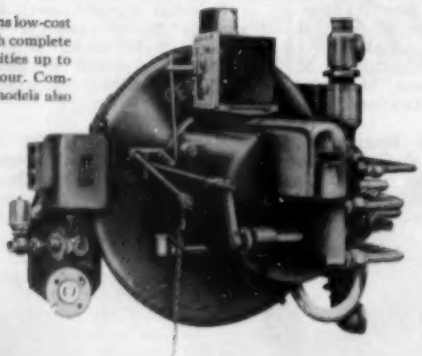
is inefficient firing stealing dollars from your pocket?

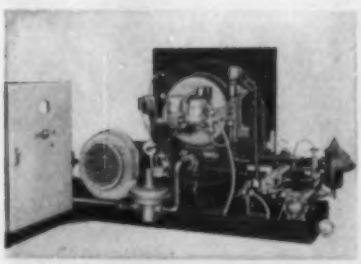
install a

PETRO INDUSTRIAL OIL BURNER

and save 3 ways

Rotary type. Burns low-cost heavy fuel oil with complete reliability. Capacities up to 200 gallons per hour. Combination oil-gas models also available.





Petro "Packaged Unit" (for oil or gas or both). A complete combustion system in which all elements are correctly balanced and integrated. Simply bolt to boiler front and make service connections and it's ready to go.

1. Fire low-cost oils

Petro fires the heavy fuel oils (Nos. 5 and 6) which average 8% richer in heat value than the light burner oils, and cost less per gallon.

2. Save fuel and labor

They efficiently fire heavy oils with complete dependability, following load changes automatically. This makes fuel go farther and saves labor.

3. Low maintenance cost

They are sturdily built and thoroughly reliable. This means low maintenance costs.

There's a Petro burner to fit almost every boiler, in sizes from 11 to 200 gallons per hour.

Heating contractors everywhere recommend and install Petro oil equipment. For illustrated catalog write Petro, 3024 West 106th Street, Cleveland 11, Ohio.

In Canada, write 2231 Bloor Street West, Toronto, Ontario.

Residential Oil and Gas Burners, Oil and Gas Furnaces and Boilers, Industrial and Commercial Oil, Gas and Oil-Gas Combination Burners

PETRO

T.M. REG. U.S. PAT. OFF.

Over 50 Years of Leadership in Automatic Heating and Power Equipment

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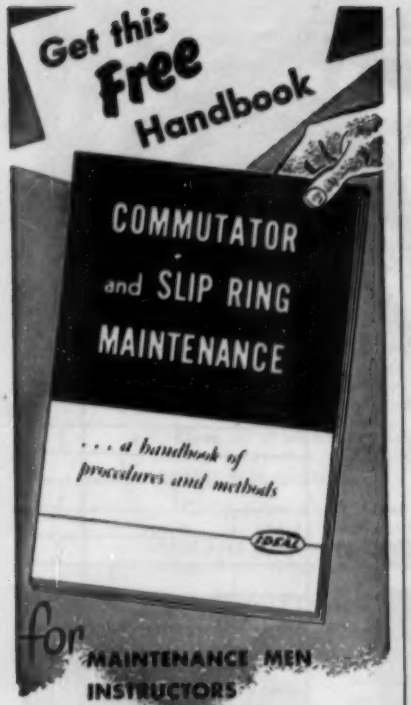

for MAINTENANCE MEN
INSTRUCTORS
and TRAINEES
in Motor Maintenance

THE methods and procedures described were developed by recognized, practicing maintenance authorities. They have been proven by conclusive evidence over many years in hundreds of operations. A concise guide, this 39-page handbook tells the practical operating man everything he needs to know about:

- Commutator and slip ring troubles and how to correct them.
- Brush maintenance and operating procedure.
- General maintenance procedure.

Dozens of illustrations show the operations described. Condensed data on IDEAL commutator and slip ring products is included.
Even if you do not have a regular maintenance training program, your people responsible for motor and generator maintenance need, and will do a better job, with the help of this handbook.

NOTE: This offer is limited to those in plant and other industrial operations. We reserve right to limit quantities furnished. Offer may be withdrawn at any time.

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1023 Park Avenue, Sycamore, Illinois

Please send _____ copies of your free handbook on commutator and slip ring maintenance.

Name_____
Title_____
Company_____
Address_____
City_____ Zone_____ State_____

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names make news

. . . personalities from industry and power

The Babcock & Wilcox Co. and the **Seaboard Refractories Co.**, have signed an agreement under which Seaboard's entire manufacturing facilities will be devoted to producing special refractories for B & W's Refractories Div.

Sales representative for the Tubular Products Div. of B & W for the Oregon, Washington, British Columbia, Alberta, and Saskatchewan area will be **E. T. Wilson, Jr.**

National Conference on Industrial Hydraulics — Carl E. Schmitz, vice president and general sales manager of the **Crane Packing Co.**, is appointed director of the institute for 1954.

Continental Foundry & Machine Co., Copes-Vulcan Div. announces appointment of **John A. Vanyo, Jr.** as assistant sales manager, **O. H. Keeling** as manager of combustion control engineering, and **R. L. Bruce** as senior contract engineer.

Minneapolis-Honeywell Regulator Co. announces the election of **Charles B. Sweatt** to the newly created post of vice chairman of the board along with the election of **Tom McDonald** and **A. M. Wilson** as executive vice presidents.

The Industrial Div. is adding 16 sales engineers to the field sales force: **K. J. Lesker**, Dallas; **O. E. Krienke**, New Jersey; **W. J. Boschert**, St. Louis; **W. G. Henderson**, Chicago; **R. P. Norton**, Indianapolis; **W. J. Young**, Houston; **W. C. Curp**, Dayton; **W. T. Lisenby** and **J. T. Gentry**, Los Angeles; **J. L. Ciprari**, Minneapolis; **K. Batchelor**, Houston, and **W. L. Bolton**, Atlanta; **R. J. Raycroft**, Toronto; **T. M. Hunt** and **W. F. Harrison**, Montreal, and **H. E. Allison**, International Div.

Reliance Electric and Engineering Co. — Promotion of **C. V. Gregory** to the newly created position of manager of district sales is announced along with several other changes in the sales force. **Elwood H. Koontz** takes Gregory's place as Pittsburgh district manager. **F. Raymond Obenchain** succeeds Koontz as Newark branch manager.

C. B. Allen, Jr. is now Detroit district manager. His former position as Buffalo district manager is taken over by **Wilmer K. Schlotterbeck. Anthony C. Schettler** moves to Baltimore as branch manager.

New sales engineers are: **A. W. Bridges** and **L. W. Kutz**, Phila.; **C. A. Emmert**, Baltimore; **James W. Landers**, Newark; **W. M. Morris, Jr.**, New Haven; and **W. J. Constandse**, Cincinnati.

General Electric Co., Carboloy Dept. announces a one million dollar expansion program for 1954.

Alfred M. Thomson, Jr. is named manager of the east central sales district to replace **W. S. Baker** who becomes manager of tool sales in Detroit. Two newly created sales districts, south central and New England will be managed by **J. D. Kennedy** and **Harry H. Jason**, respectively.

Davis Engineering Corp. announces the election of **A. O. Jaeckel** to the office of president, and **Frank F. Kunca**, formerly comptroller, to treasurer. Jaeckel will continue also as general manager.

The International Nickel Company, Inc. — J. M. Weldon is transferred to the general sales dept. as assistant to the vice president.

In other appointments, **C. J. Bianowicz** is named manager of the Inco nickel alloys dept., and **Daniel W. Machon** is placed in charge of the newly established cobalt section of the nickel sales dept.

Raybestos-Manhattan, Inc., Manhattan Rubber Div. announces appointment of **C. P. McHugh** as assistant director of research and product design. **S. F. Horesta** succeeds McHugh as

SAFETY AWARD

Bronze plaque marking the best safety record in 1952-53 of any major plant manufacturing mineral wool products is received by the Santa Clara, Calif. plant of Owens-Corning Fiberglas Corp. from the National Mineral Wool Assn. Left to right are: P. L. Welsh, plant manager; L. R. Kessler, vp and general manager, Pacific Coast Div.; Harold Boeschenstein, company president.

manager. **E. D. Hines** will be assistant manager.

I-T-E Circuit Breaker Co. has acquired a controlling interest in the **Chase-Shawmut Co.** of Newburyport, Mass. **William S. Edsall** will continue as president of Chase-Shawmut. **P. G. Johnston** is elected vice president; **Laurence B. Cheney**, treasurer; and **David Greer**, secretary.

Nordberg Manufacturing Co. — J. Frank Knorr, Inc. of Miami and Tampa, Fla. are appointed distributors for the Nordberg type 4FS engine.

Yarnall-Waring Co. — Robert S. Shrader is appointed factory representative for the Washington, Oregon, northern Idaho territory with offices at 4003 Aurora Ave., Seattle, Wash.

Shrader **Wood**

Worthington Corp. — Joint incorporation of a new Japanese-American company under the name Niigata Worthington Co., Ltd., is announced. Associated with Worthington in the venture is the Niigata Engineering Co., Ltd., a Japanese manufacturer of heavy machinery. **Horace E. Wood** is appointed far eastern manager and will make his headquarters with the new company in Tokyo.

Orr & Sembower, Inc. announces the appointment of **Charles M. Setzer & Co.** as sales and service representative handling Powermaster packaged automatic boilers in central North Carolina and in the northern part of South Carolina.

Dravo Corporation has been awarded the contract to build an addition to United Fuel Gas Company's Lanham, W. Va. compressor station.

Under contract with the **Westinghouse Electric International Co.**, the company will furnish all shop fabricated piping for an 8000-kw turbogenerator and boiler destined for South America. The unit will be installed in the Coltejer steam plant of the Compania Colombiana de Tejedos Fabrica, Bogota, Colombia, S. A.

The Machinery Div. of Dravo announces its Cleveland office will be located at 4207 Chester Avenue, Cleveland 3, Ohio.

The Permutit Co. expects to complete their modern metal-working plant at Lancaster, Pa. by spring of 1954 at a cost of about $750,000. The new building will house manufacturing facilities now at the Brooklyn, N. Y. plant. Later in the year, manufacture of **Simplex Valve & Meter Co.** products will also be transferred to Lancaster.

For Larger-Boiler Fly Ash Collection and Valuable Dust Recovery

BUELL 'SF' ELECTRIC PRECIPITATOR

BUELL MECHANICAL CYCLONE SYSTEM

Solves Big Problem for Small Boiler Operators!

Buell 'LR' Collector gets 99% of all 100-mesh and larger cinder discharge. Top efficiency for boilers from 100 to 2000 BHP.

Draft loss so low you can use 'LR' on the smallest natural draft boilers.

Get all the facts—write for 'LR' Bulletin. Buell Engineering Company, Dept. 90-B 70 Pine Street, New York 5, New York.

buell

Engineered Efficiency in
DUST COLLECTION

Circle 553 on Reply Card for more data

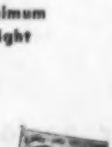
WHAT *features* DO YOU WANT *in a* Universal Joint?

- Maximum strength and bearing surface
- Quick-acting, dependable response
- Long service-life
- Optimum operating angle
- Close quarter operation
- Accurate surface grinding
- High concentricity
- Minimum weight

LOVEJOY HAS THEM ALL!

Available in 13 standard sizes — diameters 1/2" to 4" — bores 1/4" to 2" — lengths 2" to 10 5/8"

Write Now for Catalog and Prices



LOVEJOY FLEXIBLE COUPLING CO.

4843 W. LAKE ST. CHICAGO 44, ILL.

Also mfrs. of flexible couplings, variable speed pulleys and transmissions.

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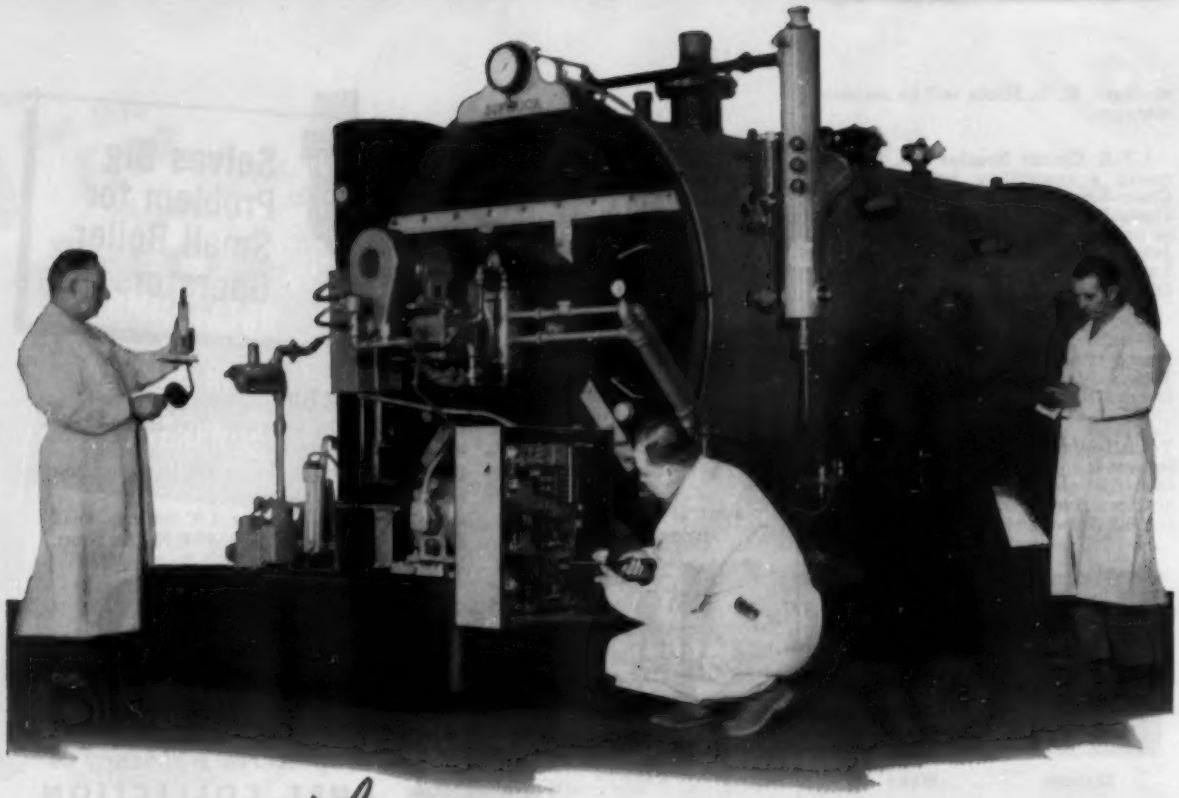

Completely FACTORY ASSEMBLED and TESTED ...for a GUARANTEED RESULT

Five Superior Steam Generators ranging in size from 30 to 600 b.h.p. on the test line at the Superior plant in Emmaus, Pa.

There's no guesswork about the performance of a Superior Steam Generator. Complete factory assembly followed by efficiency tests conducted *at the factory* under actual firing conditions guarantee operation at more than 80% thermal efficiency.

And because they are completely factory assembled and factory tested, they arrive at your plant ready to go to work . . . *backed by undivided responsibility.*

Fully automatic, firing either gas or oil, installation is simplified and inexpensive. Their rigid channel iron base eliminates the need of special foundations. Superior's built-in induced draft makes an expensive chimney unnecessary. All interconnecting piping and wiring is completed at the factory . . . ready for connection to supply services and steam outlet.

When the accent is on modernization, buy a Superior Steam Generator. It's the modern way to buy economical steam.

18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water. For complete details, write for Catalog 602.

for performance you can **BANK** on

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TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR STEAM GENERATORS

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readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pages 34/35 & 98/99

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bulletins

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AIR FILTERS & DUST COLLECTORS

232—Dust Collectors
Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrestor types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented by means of illustrated industrial installations. Kirk & Blum Mfg. Co.

233—Tubular Dust Collectors
Problems of fly ash collection are discussed in eight-page brochure 4P201. Tubular Aerotec dust collectors are described, and efficiency curves, arrangements, and standard dimensions are presented. Flue gas density tables, and a formula and monograph for calculating the number of tubes required for any volume and resistance, are presented to aid in selecting dimensions for a unit to satisfy space requirements. The Thermix Corp.

234—Industrial Dusts
"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors which influence choice of equipment, and explains the operation of each type of collector. Buell Engineering Co., Inc.

235—Dust Collectors and Arrestors
Series of four folders describes cyclone type collector and portable, standard, and automatic bag-type dust arrestors. Also includes 32-page catalog describing exhaust fans for dust collecting and air handling. Northern Blower Co.

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BOILERS & BOILER ACCESSORIES

238—Steam Generators
The advantages of shop-assembled power for your plant with Type-A water tube steam generators are explained in 8-page bulletin 52-1. Line drawings show the flexibility of design possible and dimensions. The Wickes Boiler Co.

239—Draft Inducers
The biggest contribution to the cause of improved furnace operation in recent years has been the mechanical draft inducer, according to 12-page booklet I-52. Six causes of poor chimney draft are listed. Parts of a typical draft inducer installation are numbered and explained. A selector chart is included. L. J. Wing Mfg. Co.

240—Packaged Steam Generators
Construction of packaged steam generators is described in eight-page bulletin 1050. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room is given. Ames Iron Works.

241—Flame Failure Protection
"Guarding Your Properties Against Flame Failure Explosions," booklet CP21, shows how to determine whether your fuel burner is adequately protected against explosion and briefly describes equipment to provide complete protection. Combustion Control Corp.

242—Blow-off Valves
Up-to-date information on blow-off valves for pressures up to 400 lb is given in revised bulletin B426. Lists construction features, specifications, styles and dimensions. Numerous diagrams, tables and photographs give complete details. Valve selector table given. Yarnall-Waring Co.

Pressure Equipment
One of the country's oldest manufacturers of equipment and accessories for plants piping, steam, air and gas under pressure, has published catalog 400, covering its line of separators, traps, and boiler trim. A condensation of the information in catalogs 500, 600, and 700, the booklet gives adequate size and pressure tables and technical data on the most frequently and commonly used equipment. **Please send requests directly to Wright-Austin Co., 3245 Wight St., Dept. IP, Detroit 7, Mich., on company letterhead.**

244—Boiler Baffles
"More Steam from Your Boilers," a four-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indicate how they are installed in each specific unit to secure crossflow of gases. The literature also points out how gas passes are tapered in area to obtain necessary velocity for maximum heat transfer. The Engineer Co.

246—Boiler Replacement
"What Every Business Man Should Know About Boilers," has been prepared to give executives a better understanding of boilers and a realization of the tremendous loss that industry is taking due to obsolete and inefficient steam generating equipment. Chances are two to one that your boiler is obsolete, according to this 14-page booklet. The term "packaged steam generator" is explained along with the advantages of using such units. Superior Combustion Industries, Inc.

247—Soot Blowers
Bulletin 1137 gives complete information on the Model G9B blower which employs a fixed position rotating element to clean a large number of tubes by sweeping through a pre-determined arc. The bulletin suggests the various uses for boilers, superheaters, reheaters, economizers, heat exchangers, and oil stills. The blower described is available for three pressure ranges up to and including 1500 psi. Diamond Power Specialty Corp.

248—Boilers & Stokers
Over 88 years experience are embodied in the design and construction of Scotch Marine type portable boilers says 28-page catalog. Advantages of this internally-fired, return-tubular boiler are thoroughly discussed. Photographs and cross-sections illustrate various models ranging in capacities from 6 hp up to 250 hp. Details and features of underfeed stokers designed especially for this type boiler are contained in separate section. The James Leffel & Co.

249—Boiler Service Valves
Surface blow, bottom blow-off, water column blow-off, and connections are covered in 22-page bulletin E125, with complete specifications, materials, and dimensions of each type. Valve operation is explained by illustration. Fire protection valves are included. Everlasting Valve Co.

250—Off-Center Firing
Design features of a compact, automatic package boiler are discussed in four-page folder EC-1152. The theory of off-center firing, used with these units, is discussed. Specifications for units through 250 hp are tabulated. Dutton Boilers Div., Hapman-Dutton Co.

253—Fuel Systems
Over 50 years of experience in steam generation backs up 29-page bulletin "Pulverized Fuel Systems." Well illustrated with cross-sectional drawings and graphs, it gives advantages, typical installations, and descriptions of major operating parts. Foster Wheeler Corp.

254—Packaged Boilers
Packaged automatic boilers for light oil, heavy oil, gas, or combination gas and oil firing are featured in 16-page bulletin 1219. Ratings for 15 to 500 hp units are tabulated and installations for steam process and steam and hot water service are illustrated and described. Orr & Sembower, Inc.

255—General Catalog
A wealth of research, engineering, and

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bulletins

—Starts on page 100

manufacturing experience, gained since the founding of this company in 1880, is incorporated in the products described in four-page folder. Steam generators, heat transfer equipment, pressure vessels, valves and fittings, and refrigeration equipment are shown. Henry Vogt Machine Co.

256—Boilers
Self-contained boilers for heating and processing are described in seven-page bulletin AD-100. Design is illustrated by a cross-sectional drawing and efficiency is shown by graph. Capacity and dimension tables are included. Cleaver-Brooks Co.

257—Spreader Stoker
Bulletin 897 describes a spreader stoker with overthrow rotors said to provide exceptionally uniform fuel distribution. Sizes and capacities for application to all types and makes of boilers or steam generators are shown in cross-sections and photographs. The units described will burn all grades of bituminous coal, lignite, wood, and refuse separately or in combination with coal. Detroit Stoker Company.

258—Firing Equipment
Over 50 years of leadership in the manufacture of industrial-commercial firing equipment is reflected in 19-page general catalog 3048. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included among the many illustrations. Specifications and detailed data on exclusive features of this company's oil, gas, and combination oil-gas burners are given. Petro Division.

259—Cyclonic Combustion
Principles of the patented method of Cyclonic Combustion are explained in four-page folder, "All Your Questions Are Answered by Cyclotherm." Descriptive drawings show how air is introduced into the combustion chamber at extremely high speeds in a revolving spiral vortex, radiating heat to the fire tube through direct radiation and convection. Cyclotherm Division of United States Radiator Corp.

260—Three-Drum Boilers
A pioneer in the application of 2½ in. diameter tubes to three-drum boilers describes its Type "C" boiler in revised seven-page catalog SB-49. These high-pressure, high-duty units are shown by means of cut-aways. A table gives specifications. Erie City Iron Works.

262—Vertical Unit Boiler
More than 25 years of development, manufacturing, and application experience are reflected in the design of the Type VU-10 vertical-unit boiler described in 16-page bulletin VU 10-8. Advantages and design features are discussed. Various possible installations are shown by photographs and cross-sectional drawings. Combustion Engineering, Inc.

263—Heavy-Oil Burners
Booklet 175-G, eight pages, describes the outstanding design and construction features of both the Model B oil, and the Model BR oil-gas burners, including dual-pump reservoir, fuel regulator, high-speed belt-drive, precision air-oil control, sure-fire ignition, fuel feed to atomizer, and extra long nozzle. Complete specifications, computed at 70 percent thermal efficiency, are given for both types. Preferred Utilities Manufacturing Corp.

264—Stokers
The AE Taylor Stoker is described in this booklet. Advantages, such as quick load response, small amount of stack discharge nuisance, and versatility, are discussed for units generating from 20,000 to 500,000 lb of steam per hr. American Engineering Co.

265—Boilers
Six-page catalog 98 illustrates and describes the M-800 Series boilers for high and low pressures and designed for oil or gas firing. Detailed listings of ratings, dimensions, standard equipment, and trim are included. The booklet points out that boilers in this series are ideal for use with any quality oil, gas, or combination oil-gas burner to form a complete boiler-burner unit. Kewanee-Ross Corp.

266—Steam Gage Illuminators
Mercury vapor illuminators for steam gages are the subject of data sheet 196. Unmistakable water level indication is provided by a brilliant green spot at the water level. How it is installed on standard gages is discussed. Jerguson Gage & Valve Co.

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BUILDING MATERIALS & MAINTENANCE

267—Iron Cements
Suggestions for simple reliable repairs on equipment and piping using iron cement are presented in 40-page pocket-size pamphlet. Patching cement, aluminum and bronze cement, concrete paint, gaskets and clamps are also presented. Also included is a folder describing advantages and how to apply concrete paint No. 15, for interior or exterior use. Smooth-On Manufacturing Co.

268—Thread Compound
A data sheet gives complete information on C-5 "Hi-Temp" thread compound. A sample will be sent along with the data sheet. Felt Products Manufacturing Co.

270—Maintenance Book
"Genius at Work," is a handy booklet full of ideas for plant maintenance. This company has developed Kroll, a chemical for loosening frozen parts. Kano Labs.

271—Repairs
With the theme "It's wise to economize," four-page folder 805 explains how company's repair department facilities can save you money. Pressure vessels, jacketed kettles, and agitated reactors can be retubed, rebuilt, remodeled or redesigned for new requirements. Manning & Lewis Engineering Co.

272—Flooring
"Hand Book of Building Maintenance," gives valuable information on keeping your plant in efficient working order. Instant-Use concrete floor patch is described with suggestions for its use, along with other materials for repairing floors. Flexrock Company.

273—Pipe Joint Compound
With the literature on this waterproof sealer for pipe joints carrying water, gas, or low-pressure steam, a sample of the compound will be sent. Key Company.

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ELECTRICAL EQUIPMENT

274—Dry Type Transformers
How to use dry type transformers profitably in your plant is explained in folder DT 195 which also includes wiring diagrams. Acme Electric Corp.

275—Variable Speed Motors
How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed. U. S. Electrical Motors, Inc.

276—Fuses
Hi-Cap fuses for the protection of loads above 600 amp are described in six-page bulletin HCS. Two handy charts are included: Current Limiting Effect and Opening Time Curves. Use of these fuses in conjunction with Fusetron fuses is explained. Bussmann Manufacturing Co.

277—D-C Power
D-c power sources and supplies are described in eight-page booklet B-1049. Mechanical and electrical specifications are given for the Nobratron. Sorensen and Company, Inc.

280—Motors
Advantages of the various types of motors made by this company are given in four-page folder 23. Descriptions of single-phase and polyphase motors are included along with a listing of their specifications. Wagner Electric Corp.

282—Flexible Conduit
Extra flexible Sealtite conduit for electrical wiring of machine tools and industrial equipment is pictured and described in four page pamphlet EF-531. It points out the fact that this liquid-tight, extra flexible conduit is approved for these uses by the Joint Industry Council. American Metal Hose Branch, American Brass Co.

283—Synchronous Motors
Synchronous motors, their operation, and control are described in 16-page bulletin GEA-5673. Problems common to synchronous motor applications and their solution by using the correct control equipment are explained in a question-answer technique. General Electric Co.

285—Circuit Breakers
"What You Should Know About Circuit Breakers," 16-page manual 101, explains the operating principles of basic circuit breaker design. Included are simplified diagrams of three basic types. Explanations, charts and diagrams deal with temperature factors, inrush current effects, tripping and reset time, quick and slow make-and-break, and wire deterioration rates. Heinemann Electric Co.

286—Commutators and Slip Rings
"Commutator and Slip Ring Maintenance," 39-page handbook, covers trouble shooting, brush maintenance and operating procedure, and general maintenance. Illustrations show the operations described. Ideal Industries, Inc.

287—Conduit and Fittings
Catalog 65, 63 pages, covers the entire line of electrical conduit and cable fittings manufactured by this company. Each product is indexed for easy reference. Tables list current-carrying capacities, dimensions, weights, and decimal equivalents. Thomas & Betts Co.

288—Induction Motor Standards
New NEMA standards for 1 to 40 hp induction motors have been published in seven-page bulletin 1600. A comparison of the principal dimensions of the old and new NEMA frames is included in table form. The Louis Allis Co.

290—Renewable Fuses
Sixteen-page bulletin S-40 describes the Economy De-Lay renewable fuses which are said to give safe and dependable time-delay on overloads. For every requirement, these fuses have inexpensive links which are easily replaced. Economy Fuse & Manufacturing Co.

291—Communication Systems
This data kit describes low-cost communication networks which make it possible to talk from control points to plant and between plant sites. Ease of installation is described along with the many possible arrangements for specific needs. Farmers Engineering and Mfg. Co.

294—Metal Clad Switchgear
The HV line of metal clad switchgear is described in bulletin 7004B. Advanced engineering, refined design, and quality construction are included in this line according to the bulletin. I-T-E Circuit Breaker Co.

ENGINES & TURBINES

295—Steam Turbines
Fully-illustrated 24-page bulletin 1961 emphasizes the flexibility of design of the type-S turbine which is said to make possible selection of the proper number of stages, governor, and controls to give maximum efficiency for your steam and operating conditions. Each component of the system is pictured and described. Worthington Corp.

296—Multi-Stage Turbines
Smaller framed, multi-stage turbines are featured in six-page bulletin. Overspeed governor, governor valves, blades, diagrams, and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

298—Diesel Engines
Smaller and lighter, but for heavy-duty service is the description of a diesel engine discussed in 12-page bulletin 10037. Three models are listed, ranging from 200 to 380 hp at 900 to 1000 rpm. Specifications and performance curves are included. Ingersoll-Rand Co.

299—Steam Turbines
Full details of this company's steam turbine are given in bulletin 135. Drawings and installation photographs point out the special features. How to save operating and maintenance costs by buying the right size turbine for individual needs is explained. Coppus Engineering Corp.

300—Steam Turbines
If you use steam for heating, cooking, or processing, you can get power at almost no cost with the use of a Wing steam turbine according to bulletin SW-1a. Construction of these units gives an almost infinite range of speeds, easy control by throttling, and the units are independent of any electric power failure. L. J. Wing Mfg. Co.

301—Turbines
Full details on this company's mechanical drive turbines are presented in a fully illustrated bulletin. These units are described as standard turbines, but "tailor-made" to your requirements. How they can be adapted to practically any operating condition or service is explained. Elliot Co., Steam Turbine Dept.

FANS & BLOWERS

302—Propeller Fans
Three new models are among the 13 types of fans shown in 40-page bulletin A-109. It also describes three types of

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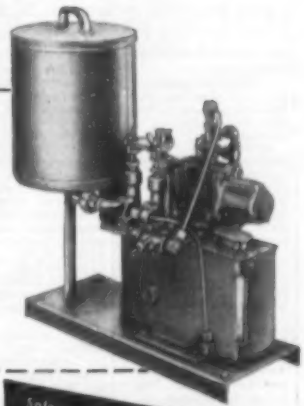

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American Brass Company	Ludowici-Celadon Co.
American Lumber & Treating Co.	Open Steel Flooring Institute
Anderson-Prichard Oil Corp.	Pabco Products, Inc.
Bethlehem Steel Company	Pittsburgh Coke & Chem. Co.
Borden Metal Prods. Co.	Pittsburgh Corning Corp.
Brick Waterproofing Co.	Plasteel Prods. Corp.
Dixon, Joseph, Crucible Co.	Plexiglas Div., Rohm & Haas Co.
Drave Corporation	Reliance Steel Prods. Co.
Dreihmann Paving & Flooring Co.	Revere Copper & Brass, Inc.
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	Uvalde Rock Asphalt Co.
	Wheeling Corrugating Co.
	Wilbur & Williams Co.

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bulletins

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roof ventilators, unit heaters and intake air units, and includes specifications, dimensions, and performance figures on all of the equipment plus valuable engineering data. A special feature is a discussion of corrosion-resistant materials and coatings which includes a table showing the suitability of special materials and coatings for use for a wide variety of fumes commonly encountered in industrial installations. Hartzell Propeller Fan Co.

303—Axial Fans
This 35-page catalog, B-1013, is designed to acquaint the user with axial fans. Technical data furnished permits the proper selection of types and sizes. Physical dimensions are shown to assist in preparation of preliminary layouts. American Blower Corp.

304—Ventilating Fans
Description of many types of fans and blowers are presented in 30-page catalog 400, along with engineering data on how to select and install the proper fan. Chelsea Fan & Blower Co., Inc.

FILTERS, STRAINERS & PURIFIERS

305—Valves and Strainers
Forty years of service are behind the information presented in bulletins 128-A (pipeline strainers) and 228 (pressure reducing valves). Cross-sections, tables, and diagrams are used to point out the advantages of this company's products. McAlear Manufacturing Co.

306—Twin Strainers
Twin strainers for filtering foreign matter from oils, grease, tar, glue, sugar juice, and similar viscous fluids are described in 4-page leaflet, A-17. They are available with inlet sizes from 1 through 10 in. for working pressures to 500 psi. Elliott Co., Accessories Dept.

HEAT EXCHANGERS & WATER HEATERS

308—Temperature Control
A simple method of controlling the temperature of liquid or gas is explained in four-page folder 120 on heat exchangers. Cutaway drawings illustrate how the units operate and flow diagrams show how controls keep a fluid at uniform temperature. Bulletin 111 gives uses of the Aeropass Condenser. Cross-sectional drawings explain the operation of wet bulb and finned coil models. Niagara Blower Co.

309—Heat Transfer Equipment
Various types of heat transfer equipment are among the products described in 12-page catalog 12. Also presented are various types of dry blending equipment and such process equipment as kettles, evaporators, vessels, reactors, and coils. The Patterson-Kelley Co., Inc.

310—Water Heaters
A streamlined system of heating water and process liquids quickly and at low cost is explained in this bulletin. The Instant Heater described eliminates the need for reducers. Cross-sectional drawings explain how the unit operates. Johnson Corp.

311—Instantaneous Water Heater
Answers to your hot water problems are given in booklet "Methods and Means." Operation and advantages of the instantaneous water heater as compared to the indirect method heater are discussed and illustrated. Pick Manufacturing Co.

HEATING, AIR CONDITIONING, & REFRIGERATION

312—Heating Specialties
How to design a one-pipe hot water system is explained in eight-page booklet J-355. In addition to discussions, data tables and diagrams are included. Many types of heating specialties are described, including a circulator, flow valves and fittings, relief valves, vents, a charging valve, compression tank. The Trane Co.

313—Electric Comfort Heaters
Listed in eight-page catalog D-52 are 75 different models of forced air, convection, and radiant heaters in capacities of ¼ to 100 kw. Aids include a quick selector chart which shows how to calculate heat requirements for given areas and types of buildings. Edwin L. Wiegand Co.

314—Unit Heaters
Catalog CUH 846-A gives the complete story on Grid unit heaters. Catalog BC-1040 describes Grid blast coils for process drying. How the construction of the unit heaters prevents electrolytic corrosion is explained in booklet "Corrosion in Unit Heaters." D. J. Murray Manufacturing Co.

INSTRUMENTS & CONTROLS

319—Instrumentation
Illustrated eight-page booklet R-8, "Results," presents the case history of a large independent electric power producer. In addition to discussions of the use of steam, fuel and ash handling, and plant steam demand, the combustion control system is also fully described and illustrated. The Hays Corp.

320—Measuring Devices
Information on more than 115 testing and measuring devices are contained in 64-page catalog GEC-1016A. A brief description of each product and its field of application, condensed tables of important characteristics, and prices indicate whether or not the instrument is suited for a specific job. Products range from simple current indicators to completely automatic oscillographs, and from surface roughness scales to mass spectrometers. General Electric Co.

321—Flow Meters
With an alarm control, the flow meters described in this bulletin have only three moving parts. How it operates to ring a bell, light a light, or activate a motorized valve is explained by means of illustrations. Henszey Co.

322—Level Control
Bulletin PC-37 describes floatless level control unaffected by surface agitation or equipment vibration. Drawings show typical installations and details of operation. Leslie Co.

LUBRICANTS & LUBRICATION EQUIPMENT

323—Lubricating Oil
Excellent time-temperature characteristics, and application by any method are advantages listed in technical data sheet 17, for newly developed lubricating oils. Physical properties and other advantages are discussed, and a chart shows service life characteristics. Sun Oil Co.

324—Force Feed Lubricator
High pressure force feed lubricators, designed for service at pressures to 30,000 psi, are dealt with in 12-page catalog 25G. Tables show output, dimensions, and specifications. Information is given on how to order the correct unit and fittings. Manzel Div., Frontier Industries, Inc.

325—Oil Reclaimer

Subject of four-page folder R-247 is a self-contained, compact oil reclaimer for keeping industrial oils free from contaminants. In addition to describing how the process works, the bulletin suggests a few of the more common applications. The Hilliard Corp.

326—Lubrication

The answer to the problem of securing maximum over-all efficiency in lubrication lies in determining the kind and quality of the lubricant, and the method of application that is best suited to each case. This 43-page handbook will help you select the lubricant for your particular needs. Recommendations are given for a wide variety of applications. Lubriplate Div., Fiske Brothers Refining Co.

327—Lubricant

This instructive bulletin explains the uses and advantages of Non-Fluid Oil. According to this booklet, it cannot clog fittings, it lubricates until entirely consumed, and will not separate under pressure. A free testing sample of the oil will be sent with the literature. New York & New Jersey Lubricant Co.

MATERIALS OF CONSTRUCTION

328—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in two bulletins. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

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MATERIALS HANDLING EQUIPMENT

329—Storage Systems

"Modern Industrial Storage Systems," 12-page brochure 4303, discusses the subject of storage for raw ingredients, semi-processed, or finished material. The flexibility and adaptability of concrete silos is discussed. Descriptions of component parts and construction are supplemented with line drawings. The Marietta Concrete Corp.

330—Conveyor System

How a recently installed interfloor-conveyor system cut receiving-to-storage time is discussed in a reprint. The article tells how the system eliminated a long truck haul, stopped elevator congestion, and reduced unloading time of highway trucks. Included are descriptions of the vertical interfloor conveyor, feeder conveyor, take-away conveyor, and automatic control system. Gifford-Wood Co.

333—Coal Handling Equipment

Applications of coal handling equipment for the power plant, pictured in 40-page brochure 2410, illustrate the cumulative experience gained in thousands of installations over more than 75 years. Drawings show tested layouts for various operating conditions. Link-Belt Co.

MECHANICAL POWER TRANSMISSION

334—V-Belts

Fractional horsepower V-belts, for use in servicing light duty applications, are cataloged according to the new industry-standard numbering system. Various types of machines are listed alphabetically by company or trade names for convenience in determining the proper belt. Manhattan Rubber Div., Raybestos-Manhattan, Inc.

335—Steel Collars

Steel shaft collars are shown in use on industrial lift trucks, printing presses, textile machinery, and other industrial equipment. Advantages of this type of collar are listed and a specification table is included. Standard Pressed Steel Co.

337—Power Transmission

Power transmission products to meet the requirements of today's machinery and production are described in an eight-page catalog. Advantages of special construction features are pointed out by means of cross-sectional drawing and text. Specifications are listed in tables for easy reference. Lovejoy Flexible Coupling Co.

338—Eddy-Current Machinery

"Basic Principles of Eddy-Current Machinery," a section of 16-page bulletin GB1, explains the fundamental principles of generating torque by means of eddy-current devices. Another section, "Characteristics of Rotating Equipment," contains engineering data. Descriptions are included of typical eddy-current equipment such as adjustable speed drives and couplings. Dynamatic Corp.

339—Rayon Belting

Transmission belting with rayon instead of cotton plies was proved in field applications for more than four years on jobs specially selected for their severity according to four-page folder A5163K. Uses and advantages of the several types of Thor belting are listed. Goodyear Tire & Rubber Co.

PACKING & GASKETS

341—Metallic Packings

Included in an eight-page leaflet are service recommendations for "V" metal insert packings, metallic valve stem, plastic core metallic face, all metallic, flexible metallic, high temperature aluminum, and braided copper packings. Standard sizes, packages, and approximate weights for each type are also listed. Raybestos-Manhattan, Inc., Packing Div.

343—Packings

Darcova pumcups, which permit equipment to be operated at reduced speeds, are described in two bulletins: No. 4502 on Pumcups for air or hydraulic mechanisms; and 4401 on units for reciprocating pumps. How these units decrease maintenance and lower operating costs is described. Darling Valve & Manufacturing Co.

344—Power Plant Applications

How to get the best results from packings is outlined in useful 6-page folder PK-61-A entitled, "Packings for the Power Plant." Each of 28 types of packings and gaskets is illustrated, briefly discussed and numbered for quick reference. These numbers are then used on a schematic drawing of a power plant to indicate recommended applications. Johns-Manville Corp.

PIPE, TUBING & HOSE

345—Prefabricated Conduit System

Introduced in four-page folder 5210 is a newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. Also included are traps, valves, and expansion devices. The literature explains how the system is installed and stresses the simplicity of making joint connections. The Ric-wiL Co.

346—Pipeline Expansion

Catalog 135, 24 pages, is packed with engineering applications and selection data

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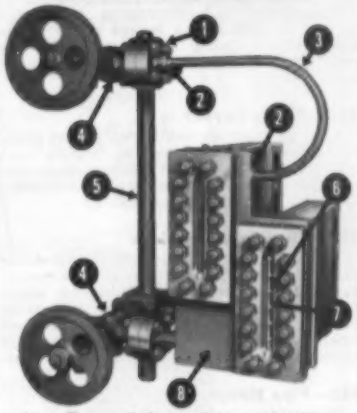

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bulletins

—Starts on page 100

necessary to the proper solution of pipeline expansion problems. The center spread is devoted to a schematic piping layout illustrating various expansion joint applications and principles. Flexonics Corp.

347—Rubber Linings

Application of rubber lining to prevent corrosion of tanks, pipes and valves is discussed and illustrated in 4-page folder. In addition, a 2-page reprint tells how rubber lining can stop circulating pipe corrosion. La Favorite Rubber Manufacturing Co.

349—Piping Layout

How to plan an industrial waste treatment system is described in "Piping Layout No. 70." The booklet includes diagrams, specifications, and other detailed engineering data. Jenkins Brothers.

350—Flexible Metal Hose

For what purpose do you use flexible metal hose? Whatever your application, you will find valuable information about job tested and certified hose in catalog 500. Included are data on steel, stainless steel, monel, and bronze hose in sizes 1/3 to 36 in. ID. Atlantic Metal Hose Co., Inc.

353—Pipe Hangers

This hanger catalog describes the complete line of adjustable pipe hangers and supports made by this company. Specifications, drawings, and engineering data are included. Grinnell Company, Inc.

PUMPS & COMPRESSORS

354—General Catalog

Equipment for buildings and institutions is the subject of 20-page bulletin WP-1099-B27M. Condensed information is provided on such equipment as air conditioning and refrigeration products; oil, gas and dual fuel engines; deaerators and deaerating heaters; water conditioning; steam turbines and turbine generators; liquid meters; centrifugal pumps; regenerative turbine pumps; vertical turbine pump; and multi-V drives. Worthington Corp.

355—Opposed Impeller Pump

How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacities to 1000 gpm, pressures to 1200 psig, and temperatures to 350 F. Typical applications are tabulated. DeLaval Steam Turbine Co.

357—Pump Valves

Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

358—Turbo Pump

Each component of the type DE turbo pump is pictured and its design advantages explained in a six-page folder. The lubrication system is also described in detail. Typical uses are listed. The J. S. Coffin, Jr., Co.

359—Proportioning Pump

An explanation of the operation and advantages of reciprocating mechanical drive metering and proportioning pumps is given in 20-page brochure UP-52. Technical information on how to select the proper unit as well as service recommendations for handling over 300 substances is presented. Hills-McCanna Co.

360—Vertical Pumps

"Vertical Pumps for Volatile Fluids," six-page folder 1026, appraises the advantages of vertical turbine pumps for handling such liquids as gasoline, diesel fuel, crude oil, L-P gases, and ammonia. Efficiency curves included. Johnston Pump Co.

363—Compressors

Two-stage air-cooled compressors for stationary or semi-portable use are described in 11-page bulletin 759. Photographs and cross-sections point up the special features of the units which are arranged for belt-drive, coupled, or "built-in" motors. Chicago Pneumatic Tool Co.

364—Non-Clogging Pumps

Type U non-clogging pumps designed for handling liquids carrying large amounts of solids and foreign materials are described in 11-page bulletin 730-C. The specific uses of each type pump are given along with tables to help in selection. Cross-sectional drawings are used to present special features of different types. Weinman Pump Manufacturing Co.

365—Pump Package Systems

This catalog describes pump package systems including welded steel tanks in standard sizes of 50, 100, 175, 250, and 500 gal complete with all accessories. The Manajust Stroke adjustment for varying

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capacity when pump is not operating, and the Autajust for precise control of flow while pump is running are explained. Orchem Pump Div.

366—Pumps

Condensed catalog "M" describes pumps for every purpose. Among those described are: turbine type pumps for use with small capacities and high heads; and type 66U side suction centrifugal pumps. Aurora Pump Co., Div. of New York Air Brake Co.

REFRACTORIES & INSULATION

368—Refractories

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. Important information including recommendations for each is presented. Photos depict application and end results. The Babcock & Wilcox Co., Refractories Div.

369—Refractories & Insulation

Catalogs R-52 through I-93, compiled in a binder, form an illustrated 40-page booklet showing where, when, and how to use various types of materials for industrial heat generation and processing equipment. An index is included for quick reference. Refractory & Insulation Corp.

370—Heat Resistant Concrete

Useful engineering data and information pertinent to the structural design of refractory and heat-resistant concrete is contained in illustrated 12-page booklet PP-5M. Subjects such as strength, volume changes, methods of reinforcing, sprung arches and domes, application to ducts, and stack linings are dealt with. Universal Atlas Cement Co., Lumnite Div.

371—Industrial Insulation

"J-M Products for the Process Industries," eight pages, is arranged as a ready reference for men responsible for the design, installation, and operation of process equipment. It gives concise data on the properties of the various products and includes photographs showing typical installations. Johns-Manville Corp.

STEAM SPECIALTIES

372—Thermostatic Steam Traps

Balanced pressure thermostatic steam traps for pressures to 300 psi and capacities to 36,500 lb condensate per hr are discussed in four-page folder 250-A. Construction details, operating principle, advantages and maintenance are discussed and illustrated with photos and cutaways. Screwed strainers are also briefly presented. Sarco Co., Inc.

373—Trapping Practices

Engineers concerned with steam traps should find 48-page catalog J a valuable source of data on recommended trapping practice. In addition to explanation of how to calculate condensate loads and select traps, a maintenance section covers installation, preventive maintenance, trouble shooting, and repair. Armstrong Machine Works.

374—Steam Traps

Catalog 68G, 31 pages, describes and illustrates steam traps, strainers, regulating and reducing valves, separators, and vacuum and lifting traps. Included are applications, dimensions, and a handy steam properties table. Strong, Carlisle & Hammond Company.

375—Welded Floats

Units made of stainless steel, monel, and chrome plated steel, in spherical, eliptical, and cylindrical shapes are shown in eight-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

376—Separator Catalog

Instead of working out long equations and formulas you can, with the help of four-page bulletin 201, look at a graph and decide the size Hi-eF Purifier to meet your operating conditions. Specifications and applications of these line-type purifiers are also given. V. D. Anderson Co.

377—Float Traps

If you are planning to install low, medium, or high pressure float or float and thermostatic traps, you will need this illustrated catalog sheet. According to the data sheet, once these valves are installed, there is no necessity for the breaking of any pipe connection for cleaning or repairing. All working parts are made readily accessible by removing the cover of the trap. Hoffman Specialty Manufacturing Corp.

379—Steam Trap

The Drainator steam trap with no moving parts is described in this illustrated bulletin. Advantages, such as the fluctuating gage glass which signals when the trap is functioning properly, are discussed. Coe Manufacturing Co.

380—Trap Selector

Handy, 20-page bulletin T1750 lists common industrial and process equipment and shows how to select proper size trap for each type. Tables show trap capacities, factors of safety, and pressure conditions. Yarnall-Waring Co.

383—Condenser Tube Inserts

How to restore leaking condenser tubes to service by sealing off the deteriorated portion with inserts, is the subject of four-page leaflet 500. Tube cleaners, expanders, and maintenance tools are listed. Thomas C. Wilson, Inc.

384—Tube Cleaners

Equipment for practically every tube cleaning operation is presented in 28-page catalog Y-29. Specifications for cutter heads, drills, brushes, and motors are listed in illustrated tables for quick reference. Cutaways show design features of air, steam, water, and electric powered motors. Accessories are also presented. Sections on care and operation of tube cleaners and table of inside diameters for tubes and pipes add to the booklet's value. Elliott Co., Lagonda Div.

385—Torquers

Both inch-pound and foot-pound torquers are described in this complete 66-page catalog. Types included are for a wide range of drive sizes with plain or ratchet head. **Please send requests directly to Proto Tool Co., Dept IP, 22762 Santa Fe Ave., Los Angeles 54, Calif., with 10c.**

386—Tube Expanders

Rolling and flaring tube expanders and operating accessories are listed in illustrated 8-page catalog 68. General information, specifications, and recommendations are included. A useful guide for ordering is also presented. The Gustav Wiedeke Co.

VALVES & REGULATORS

387—Valves

The various types of valves made by this company are pictured by means of blue-print drawings, cross sections, and photographs in bulletins 500—505, 508, and 600. Complete dimensions are listed in tables. W. S. Rockwell Company.

388—Temperature Regulator

Bulletin 330 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderizing, pickling, cleaning, and rinsing solutions. The Powers Regulator Co.

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390—Flow Meters

Important data on the Diaflow Meter, for measuring air flow, gas flow, and the ratio between the two flows, are presented in eight-page booklet 52-1017-37. According to the booklet, the meter is particularly well suited for industrial furnaces and sewage disposal plants. The Hays Corporation.

391—Regulating Valve

How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in four-page folder 700. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

393—Reducing Valves

Four-page folder 511-A lists actual small flow reducing valve capacities based on test data. Cross-sectional-drawings show construction of the bronze and steel valves. Leslie Co.

394—Cast Steel Valves

Booklet 12-C, 56 pages, contains information on material specifications, preparation of welding ends, flange facings, and pressure-temperature ratings. Construction and specifications for globe, angle, and check valves in 300, 600, 900, and 1500 lb pressure classes are given. Also, discussed are parabolic disk valves for hand or motor control of volume. Edward Valves, Inc.

395—Regulating Valves

Bulletin 1-A, 52 pages, gives complete information on a wide range of regulating valves for steam, water, air, gas, or oil. Illustrations, cross-sectional drawings, and specifications are included. Atlas Valve Co.

396—Valves

Catalog 10 describes List 960 and 990 valves. The 960 is for a pressure range of 2000 lb at 100 F to 380 lb at 1000 F. The 990 is for higher pressures. According to the booklet, these valves offer extra protection against excessive stress with extra-strong stem and wedge-gate connection. Chapman Valve Manufacturing Co.

397—Rubber Lined Valves

This bulletin on rubber lined gate and check valves uses cross-sectional drawings to describe operation and construction. The fully revolving double disc, parallel seat principle is explained along with other advantages. Darling Valve & Manufacturing Co.

WATER TREATMENT & WASTE DISPOSAL

398—Water Analysis

Published by a company engaged exclusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

399—Water Clarification

Major advantages of the solids contact principle for clarifying and lime softening of water, and basic requirements for sound solids contact reactor design are incorporated in 24-page bulletin 5001-A. It illustrates the basic reactor types that can be supplied by this company—round or square units with vertical shaft agitator, and rectangular units with horizontal shaft agitator. Reactors can be made of concrete, steel, or wood or combinations of these materials. Chemical feed and auxiliary equipment are described. Cochrane Corp.

400—Water Purification

"Boiler Feedwater Treatment," 19-page bulletin BFT-1, covers Inversand zeolite softeners, cold process chemical softeners, and demineralizing units, including silica removal by ion-exchange. Each process is explained by means of chemical formulas and flow diagrams. Photographs and cross-sections of equipment are included. Hungerford & Terry, Inc.

401—Ion Exchange Material

Strongly basic anion exchanger is presented in 16-page bulletin 37. Includes complete data on physical characteristics, exchange capacity and regeneration technique. Tables and graphs along with discussions explain performance under various operating conditions. National Aluminate Corp.

402—Water Treatment

Laboratory pictures in this four-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

403—Water Conditioning

Conditioning for boiler, process, and general applications is discussed in 20-page booklet 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, zeolite-alkalinity neutralization, split-stream, and anion exchange dealkalization systems are explained. Elgin-Refinite Div. of Elgin Softener Corp.

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405—Water Treatment

"Industrial Water Treatment and Engineering Service," tells of the five basic lines of defense to guard against difficulties in water and steam cycles. A two-page diagram shows a water and steam cycle power plant layout and indicates the usual tests required on samples taken at designated points. Dearborn Chemical Co.

406—Ion Exchangers

This 14-page booklet reviews generally the subject of ion exchange, established and potential applications. It gives advantages of the synthetic ion exchange resins and a bibliography of papers concerning their use. Rohm & Haas Co.

409—Water Softening

Bulletin WC-108, 12 pages, explains the distinction between the sodium and hydrogen cycle, and shows differences in results obtained by the two processes. Design and operation of zeolite equipment is described, and available methods for controlling various operations are discussed. A simple method of sizing such softeners and a table of recommended flow rate aids are given. Graver Water Conditioning Co.

410—Boiler Water Treatment

Difficulties caused through industrial water contamination are outlined in a 12-page catalog. Recommended water conditioning treatments for scale, sludge, corrosion, carryover and other boiler conditions, and efficient control methods are described. Details on a system of complete boiler water conditioning are fully explained. E. F. Drew & Co., Inc.

411—Deaerator

Bulletin 4643 contains complete details of a high efficiency deaeration unit for small and medium size power plants. Various types of installations are described along with the accessories necessary. Cochrane Corp.

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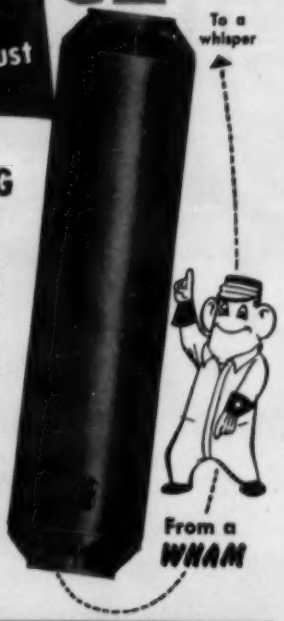

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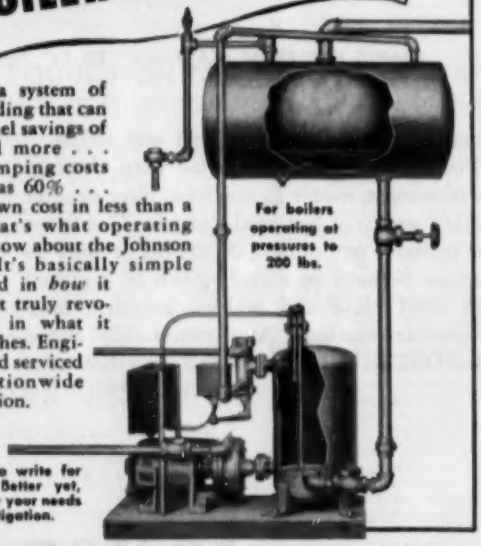

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spot news

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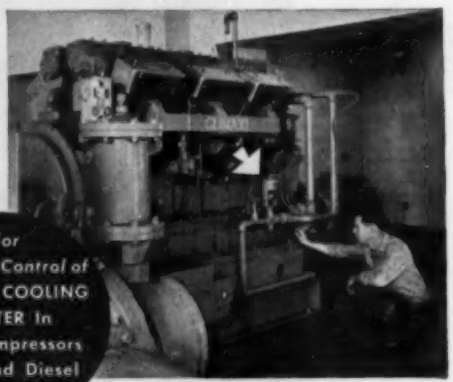

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Mar. 15-19	National Association of Corrosion Engineers (10th Annual Conferences)	Muehlebach Hotel Kansas City, Mo.
April 1-3	Electrical Maintenance Engineers Association of Southern California (Industry Show)	Shrine Hall Los Angeles
April 15-19	American Institute of Electrical Engineers (Southern Textile Conference)	Georgia Tech. Atlanta, Ga.
April 26-30	American Society of Tool Engineers (Industrial Exposition)	Convention Center Philadelphia, Pa.
May 4-7	American Welding Society (Spring Meeting)	Statler Hotel Buffalo, N. Y.
May 10-12	Compressed Air and Gas Institute (Spring Meeting)	The Homestead Hot Springs, Va.

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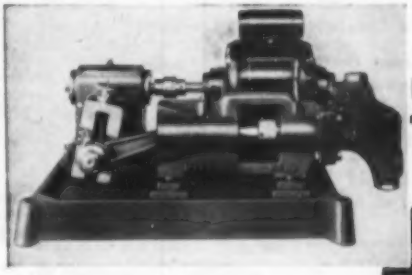

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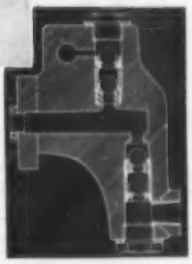

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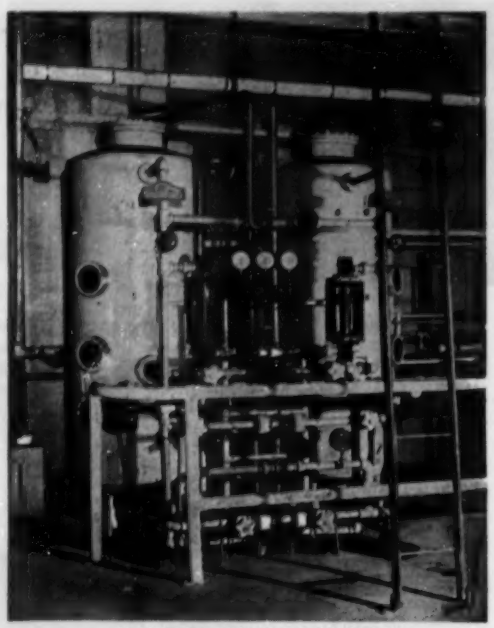

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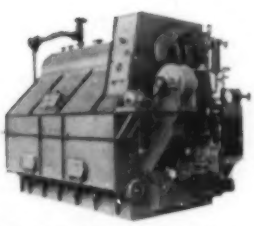

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